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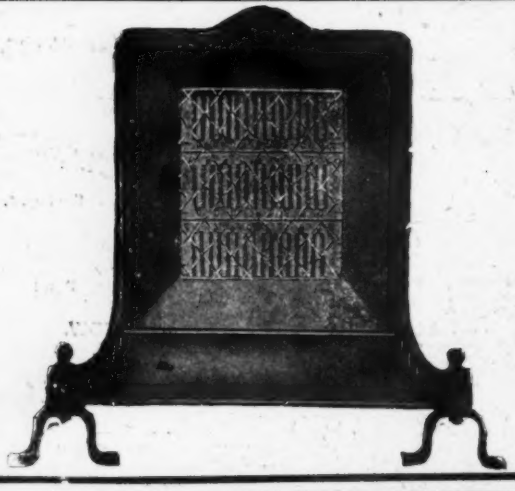

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VOL. XC. APRIL 21, 1922. No. 2,317.

ELECTRICAL REVIEW.

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NEW RAILWAY RATES FOR ELECTRICAL GOODS.

FOR some time past the Railway Rates Advisory Committee of the Ministry of Transport has been considering the new railway rates classification proposed by the railway companies, and has been hearing objections by various traders concerning particular classes of goods. The present position is that under the existing classification goods are divided into eight classes (leaving out of consideration exceptional rates in special cases), and the railway companies now propose that there should be 20 classes, class 1 being the lowest rate, and the rates increasing as the numbers progress. The question of the general classification of machines and machinery has been before the Committee, and after careful consideration it has been decided that machines and machinery should be charged at the class 12, 14, and 16 rates, *i.e.*, class 16 for consignments of less than two tons, class 14 for consignments between two and five tons, and class 12 for consignments of more than five tons. This leaves it open for objections to be made in respect of particular goods.

During the hearing of a number of objections on Thursday, April 6th, Mr. Frank Broadbent, of the British Electrical and Allied Manufacturers' Association, brought up the question of ironclad switchgear and meters for electric lighting and power. In the first place, with regard to the switchgear, he asked for concessions with regard to packing. With the development of the trade, he said, various descriptions had crept into the classification which were causing considerable confusion between railway companies and traders. The B.E.A.M.A. considered it was time for grouping certain types of articles under the one generic heading of ironclad switchgear. Owing to the increased pressures now employed, and the very severe conditions imposed upon the electrical trade by insurance companies, the Home Office and the Board of Trade, switchgear to-day was very much more robust than when first classified. This branch of the industry had grown tremendously of late years, and the Association had collected data from the principal manufacturers, over a period of 12 months, which showed that the traffic in ironclad switchgear during that period was 15,752 tons. The average rate per ton was £3, making a total of £47,256 paid in carriage. The claims on that amount of switchgear were only £504, or 1 per cent. of the amount paid in carriage, and the bulk of the goods were carefully packed. Switchgear provided good loading, up to four or five tons per truck, and the traffic was of a regular character. The Association suggested that there should be an entry in the new classification for "ironclad switchgear, with or without meters, class 18." The shipping companies had agreed to class switchgear for use in connection with dynamos and motors, as electrical machinery. Therefore, the Association would have been justified in claiming the machinery rates for switchgear from the railway companies. Mr. Broadbent explained that non-recording meters to-day were carried at class 3 rates, equal to class 18 in the new classification, and recording meters at the present class 4 rate. The trouble was that when a switch was sent with recording meters—ironclad switchgear was at present in class 3—it would have to be sent at a higher rate.

MR. PIKE, representing the railway companies, said that apparently they were asked to include meters with ironclad switchgear. He pointed out that meters were delicate pieces of machinery, and it was not reasonable

that they should be included with switchgear, which was less damageable.

When dealing with meters, Mr. Broadbent said the trade suffered severely from American and Continental competition. The Association had obtained information from ten of its members who specialised in meters, and had found that in twelve months 740,000 instruments had been sent, representing a tonnage of 3,100, including packing. The average rate was £3 per ton, making £9,300 paid in carriage. Owing to the very efficient methods of packing, the claims for damages on that amount did not exceed £50, or about half of 1 per cent. of the freight cost. The railway companies proposed that meters should be in classes 19 and 20 in the new classification, for the non-recording and recording types respectively. This represented an increase on the present rates, and he contended that the rates should not be raised. He handed to the chairman a number of meters to show that they were quite strong, and not very liable to damage. Mr. Pike said that the meters were first put into class 3 of the present classification because they were unclassified. The companies had applied to the Board of Trade, which had put them into class 4, the entry being "Electrical Instruments for Electric Lighting and Power." The railway companies had asked for class 5.

The Committee said that the classification should be maintained in both cases. Switchgear, ironclad, sent without meters, should be at the rate proposed by the railway companies, but with meters it should go at a higher rate, as proposed by the railway companies. With regard to the meters themselves, these should be in classes 18 and 19 for non-recording and recording respectively, and not 19 and 20, as proposed by the railway companies.

Representation of Labour on J.E.A.'s.

At a private conference of certain of the London Municipal Councils held on April 7th, to deal with some points on which they are in opposition to the draft scheme of the Electricity Commissioners for a Joint Electricity Authority for London, one of the items to be dealt with was an alleged ignoring of the claim for Labour representation.

The view of the Electricity Commissioners, if we may judge by the schemes already issued, is that Labour representation is not to be included in any of them. In coming to this decision we think the Commissioners are not only sound on questions of policy, but also have the law on their side. Taking the latter point first, the Electricity (Supply) Act, 1919, does not provide for any representation of Labour on Joint Electricity Authorities. That this omission is intentional will be seen by the history of the Act; the original Electricity (Supply) Bill, when it was brought from the Commons on November 27th, 1919, included the formation of Joint Electricity Authorities as an alternative to the formation of District Electricity Boards. The constitution of the District Electricity Board included specifically the representation of "labour"; but the constitution of the Joint Electricity Authority did *not* do so, and the clause remained unaltered when the Bill became law in 1919. The reason for excluding Labour from the J.E.A.'s is obvious. The District Boards were compulsory bodies with compulsory powers, whereas the J.E.A.'s are merely bodies formed by the voluntary co-operation of undertakers and others interested, a quite radical difference. It seems indisputable, therefore, that Labour was designedly omitted from the constitution of Joint Electricity Authorities. When the Bill came into the House of Lords at the end of 1919 the District Boards were entirely struck out, and only the J.E.A.'s remained, so all title of Labour to any representation entirely disappeared. Coming to the actual clause as it stands in the Act of 1919, the only possible words under which Labour could claim to squeeze in are a reference to the representation of "other interests," but no one, we think, could possibly read this as meaning Labour, especially in view of the history of the original Bill. We think, therefore, that the Electricity Commissioners are perfectly right, from the legal point of view, in including no representation of Labour.

As to the side of policy and fairness, when the Electricity Bill was first being drafted in the early part of 1919, there was no National Industrial Council in existence. It came into being, it will be remembered, in May, 1919, and thereafter District Councils were set up, and during the year a full scheme covering the whole of the industry was brought into operation. It was agreed by the Trade Union side that this system of Whitley Councils should deal with the whole of the interests of Labour throughout the industry, and it has in fact done so ever since that time. Whatever justification, therefore, there might have been for the inclusion of Labour when the Bill was first drafted has now entirely disappeared. There is no reason at all for bringing up the matter again, since if there is any point on which Labour is dissatified with the present arrangements, the proper course is to modify the existing machinery of the Whitley Councils. Representation of Labour on a J.E.A. would obviously be an anomaly, and would not harmonise in any sense with the existing Whitley Council arrangements. Altogether, therefore, we think that the Commissioners are wise in not entertaining any proposal for Labour representation, either direct or indirect.

The Electricity (Supply) Bill.

The Electricity (Supply) Bill has now passed through the House of Lords, and will, it is presumed, in a short time have to run the gauntlet of the House of Commons. In the interim, we take it, the various parties interested in the Bill will be deciding their policy for the Commons. It is to be hoped, however, that we have seen the last of the merely blocking tactics and that any amendments now put forward in the House of Commons will be only those which will directly benefit either the electricity supply undertakings themselves or else the Joint Authorities, and not be merely covert attacks on the principle of the Bill. As the Bill now stands, certain sections of the industry have indubitably a good deal to congratulate themselves upon—the power companies have obtained very important concessions and a modification in their favour of the existing Act, with the result that they are delivered from the menace which they have always feared in the shape of possible competition by a Joint Electricity Authority. Electricity supply companies have a valuable asset in the clause which empowers the Electricity Commissioners by an Order to grant extension of tenure under certain conditions, which is obviously a matter of most important consideration. Then, as to a gain by local authorities, these are now placed in the same position as companies with regard to being able to obtain revision of prices charged to consumers. Further, the period of revision for all undertakers has now been reduced from five years to three years, and a disability has been removed from certain companies which had not the power to apply for such revision owing to the early date of their Orders, and so forth. Then there is the power of Joint Authorities to lease their undertakings to authorised undertakers, and *vice versâ*. Finally, the Joint Electricity Authorities will have financial powers and be able to function, and, for the benefit of those who felt qualms about the financing, there are certain safeguards added.

Altogether, therefore, there are some very material gains to the industry in the Bill. Broadly, it would look as though those interested would be well advised to take the line of safeguarding what they had already obtained rather than again to raise the question of principles as in the House of Lords. One must anticipate a certain amount of free-lance criticism of the Bill when it comes to the Commons, but the more disputants there are in the *mêlée* the more likelihood there is, perhaps, for some of the substantial gains to be lost on this last round; so those who are fairly satisfied with the Bill should think twice before creating anything like all-round opposition and an extended attack.

EXTENSIONS AT STOKE-ON-TRENT ELECTRICITY WORKS.

When the Pottery towns were federated in 1910 and their electricity supply was brought under common management, the borough electrical engineer of Hanley, Mr. C. H. Yeaman, found himself in charge of a medley of systems operating at different voltages. The three-wire d.c. system was used at Burslem (220/440 volts), Stoke (240/480 volts), and Longton (230/460 volts), and single-phase a.c. at Hanley (100, 200, 400, and 2,000 volts, 100 cycles). Obviously unification on modern lines was called for, and it was decided to extend at Hanley with three-phase extra-high-pressure plant of 3,000-kW capacity, which was set at work in 1913; supply in bulk was given to sub-stations at the various centres, and supplemented by the local steam plant during heavy loads.

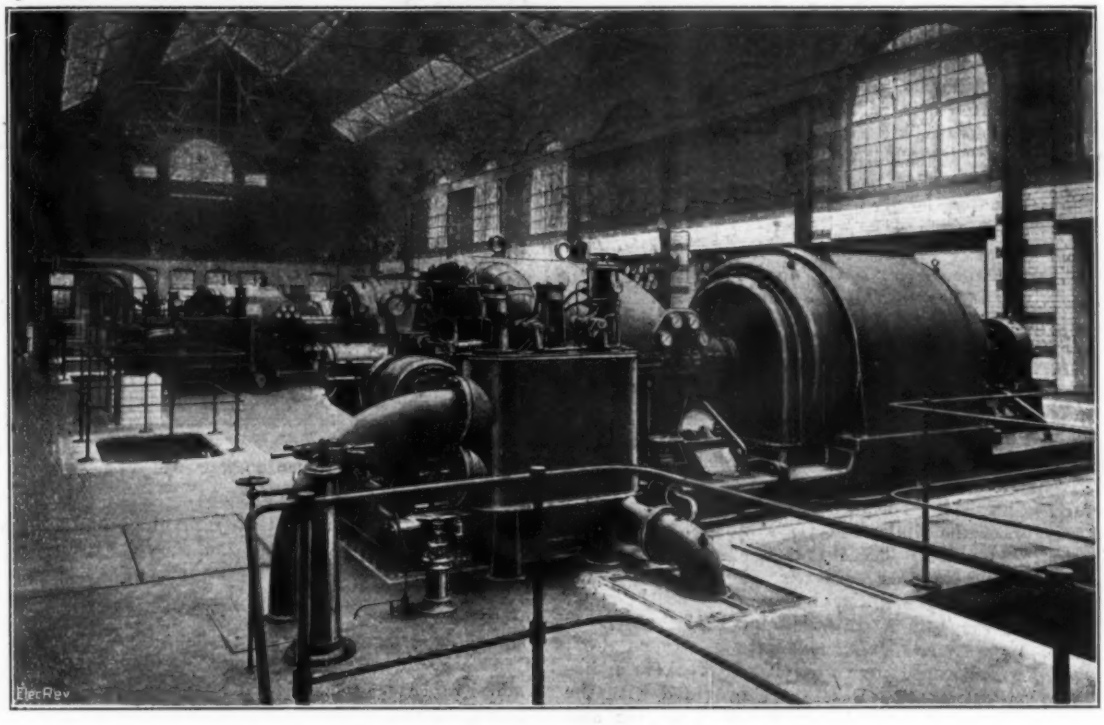


Fig. 1.—Stoke-on-Trent Power Station: Turbine-room.

The increased demand for power due to the war necessitated additions to the generating plant, and the work was put in hand in 1917, a 3,000-kW turbine being started up in March, 1919; but in October, 1918, the Corporation, on the advice of Sir John Snell, had decided to adopt Mr. Yeaman's recommendation to install additional plant, and a second 3,000-kW set has been put into service, the inaugural ceremony taking place on March 30th. Two three-phase turbo-generators of 1,000 kW each are also about to be started in the Burslem and Stoke sub-works, in place of old d.c. sets aggregating 300 kW.

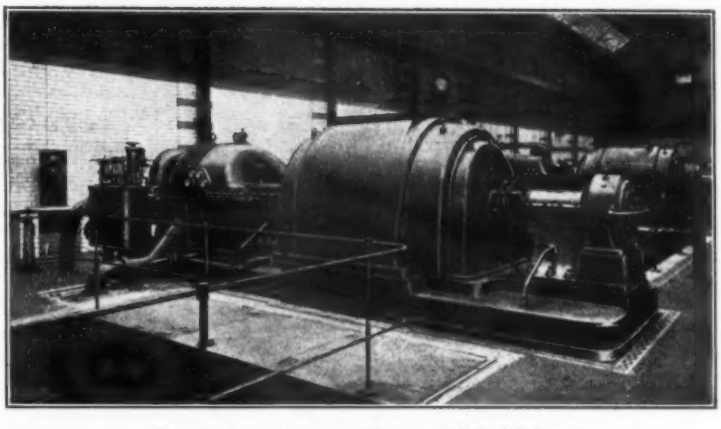


Fig. 2.—Metropolitan-Vickers 3,000-kW Set.

The new 3,000-kW turbo-alternator, together with the condensing plant and switchgear, was built by the Metropolitan-Vickers Electrical Co., Ltd.; it generates three-phase current at 51½ cycles per second, 6,000/6,600 volts. The turbine is of the Metropolitan-Vickers Rateau high-pressure impulse type, which was described in the Electrical Review of April 30th, 1920, and April 15th, 1921; the whole of the moving blading, as well as the fixed blading in the velocity stage, is of 5 per cent. nickel steel machined from the solid. In addition to the usual governors, forced lubrication, &c., an interesting feature of the plant is the system of feed-water heating adopted. The arrangement of the feed-heater is shown in fig. 4; steam is diverted from the turbine at a pressure corresponding to a vacuum of about 20 inches, together with leakage steam from the turbine glands, &c., and raises the temperature of the feed-water to about 150 deg. F. in the heater, which is practically an auxiliary condenser. Tests made by Mr. W. M. Selvey on the first 3,000-kW set showed that the effect on the efficiency of the whole set of by-passing out 5.6 per cent. of the steam at a low pressure was extremely small, and the heat gained by the feed water, raised 54.8 deg. F. in temperature, represented an improvement of about 4.4 per cent. in the total heat consumption.

The turbine works with steam at a gauge pressure of 170 lb. per sq. in. at the stop valve, superheated by 200

deg. F., the circulating water being at 80 deg. F. In the tests above mentioned, the corrected steam consumption was 12.98 lb. per kWh, with the feed heater in operation, and 12.96 lb. without it, at full load.

The condensing plant is of the Metropolitan-Vickers Leblanc surface type, the auxiliaries being driven by Metropolitan-Vickers induction motors. The condensers for the two 3,000-kW sets are provided with Mather & Platt circulating water pumps driven by 110-b.h.p. 1,000-r.p.m. motors. The main air and condensate extraction equipment consists of a Leblanc rotary valveless dry-air pump coupled to a centrifugal condensate extraction pump, the two being driven by a 28-b.h.p., 1,500-r.pm. motor. An additional equipment, consisting of a steam-operated air ejector and a centrifugal condensate extraction pump, has been installed, and a Lea recorder is provided.

The alternator is of the Metropolitan-Vickers turbo-type with self-ventilated stator and rotor. The latter is machined from a solid steel forging. The exciter is of the radial-commutator type.

The boilers are of the Stirling five-drum type, eight in number, of which the last three form part of the new extensions, and have a rated output of 31,600 lb. of steam per hour, the heating surface being 8,282 sq. ft. and the superheating surface 820 sq. ft. The mechanical stokers are of the Underfeed Co.'s make. No economisers are provided. The chimneys are of steel, 90 ft. high from the firing-floor level.

The switchgear, which is illustrated in fig. 3, is an extension of the system installed in 1913, and was supplied by the Metropolitan-Vickers Electrical Co.; it is of the cubicle type, with oil circuit-breakers of improved design. The generators are provided with the Merz-Price balanced potential system of protection and automatic field-breaking apparatus.

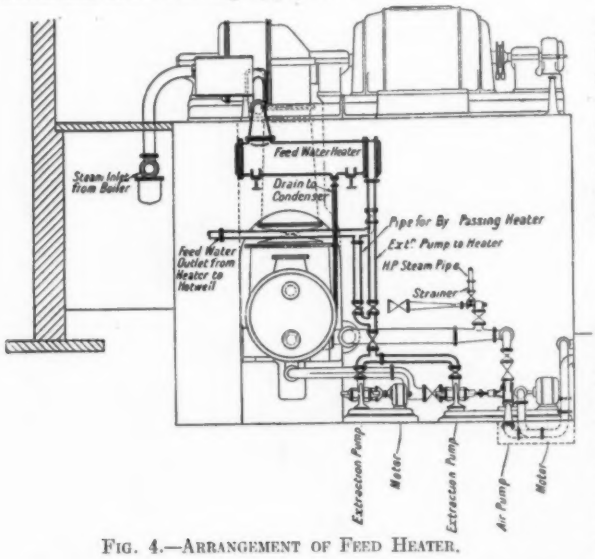


Fig. 4.—Arrangement of Feed Heater.

There are four cooling towers, built by the Davenport Engineering Co., Ltd., of the natural-draught type, the last two forming part of the extensions; these are together capable of dealing with 400,000 gallons per hour.

The coal conveyors and elevators were supplied by the New Conveyor Co., Ltd. Coal is brought to the power station by three electric automatic end-tipping vehicles, two of the Edison and one of the Orwell type. Ash is removed by trucks on rails, installed by Messrs. Matthews & Yates. The boiler feed pumps were supplied by the British Electric Plant Co., Ltd., and Messrs. G. & J. Weir, Ltd., and the piping by Messrs. Aiton and Co., Ltd.

The extra-high-pressure mains are of Messrs. Callender's make, paper-insulated, lead-sheathed and armoured, and are laid in stoneware troughs filled with compound. The new Stoke and Burslem feeders are of the split-conductor type. A motor-generator of 500 kW has been installed in the central power house by the English Electric Co., Ltd.

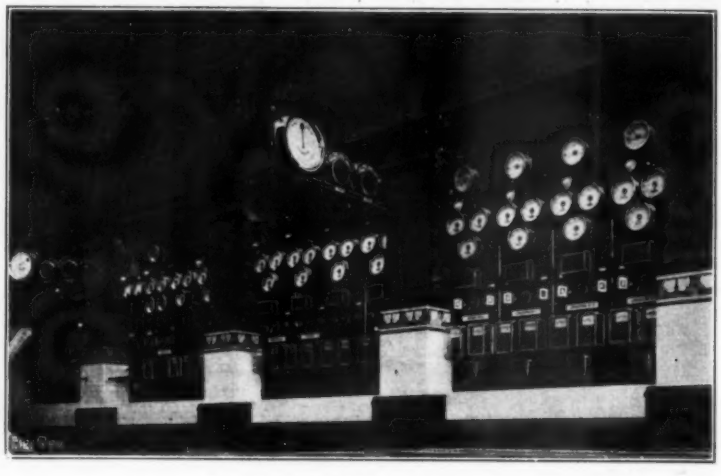


Fig. 3.—Main Switchboard.

According to the statistical returns of the Electricity Commissioners for 1920-21, the Hanley power station ranked fifth in order of merit out of 114 generating stations of 5 to 15 million kWh output per annum, and the maximum peak load was 6,185 kW. The coal consumption was 2.74 lb. per unit generated.

The new 3,000-kW set, with three boilers and auxiliaries, in 1918 was estimated to cost £102,000, as compared with an estimated cost of £33,000 in 1916 for the previous 3,000-kW set and two boilers, &c.

The two 1,000-kW turbo-generators installed at Burslem and Stoke sub-works were ordered in 1920 from the English Electric Co., Ltd., and run at 3,000 r.p.m.; a 1,000-kW rotary converter at Burslem and a 1,000-kW motor converter at Stoke are included in the extension scheme, which will be completed in the summer. The undertaking as a whole will then have a net capacity of some 8,000 kW. Authority has been obtained for a further extension of 5,000 kW, for which the plans are being prepared.

Smoke Abatement in Leeds.—A Smoke Abatement Committee has been formed at Leeds, comprising the Health Committee and representatives of the Electricity and Gas Departments, and manufacturers and business men have been co-opted. The first meeting was held on April 6th, under the chairmanship of Dr. C. H. Moorhouse, when a plan of campaign was considered, both as to industrial and domestic smoke. In view of the decline of smoke during the summer it was felt that this was not the best time to take public action, but a small committee was appointed to prepare plans for a series of lectures and other forms of publicity, to start next autumn, to which firemen and stokers of industrial works would be specially invited. It was resolved that certificates should be given at the end of a course in practical fuel economy and fuel chemistry. The public side of the question, it was decided, should be dealt with by general propaganda and meetings and through trade unions, urging the public to use electric and gas heating.

A Luxemburg Electrical Scheme.—It is reported from Luxemburg that a group headed by the Banque Centrale de Bruxelles has submitted to the Government of the Grand Duchy a scheme for the general electrification of Luxemburg. The project comprises the provision of light and power for all the towns, the supply of gas in the city of Luxemburg, the working of tramways, the conversion of the local railways to electric traction, &c.

THE MANGNALL-IRVING THRUST-BORER.

An Improved Method of Cable Laying.

The object of the machine described below is to eliminate trenching and tunnelling and the consequent heavy cost and inconvenience involved by those operations when laying pipes, cables, &c., either under the streets in towns or in the open country. The method employed is to bore horizontal holes through the ground below the surface, between pits sunk at the required distance apart; there is no cutting action and consequently no spoil, the hole being bored by the displacement and compression of the surrounding earth. This system

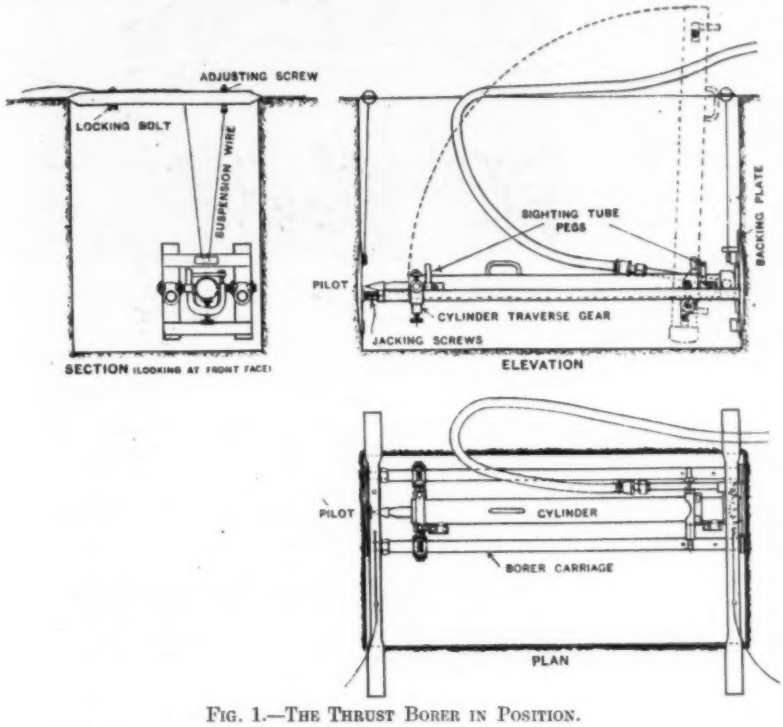


Fig. 1.—The Thrust Borer in Position.

should be extremely useful, as it enables, for example, a cable to be laid across a street without disturbing its surface; it thus obviates the necessity to obtain permission to break open the roadway for cable-laying purposes.

Many types of machines are made by the Hydraulic Engineering Co., Ltd., of Chester. The largest engine-driven one is capable of boring holes to accommodate stoneware pipes up to 12 in. internal diameter, but it should be pointed out that holes of this size can only be made in pure clay, or some other very plastic material, on account of the large amount of earth that has to be displaced. Then, again, engine-driven machines to bore 4- and 6-in. holes at an overall speed of 300 ft. per hour can make borings very accurately for a distance of 150 ft., and possess ample power in the withdrawal gear to enable heavy cables to be pulled back through the completed bore.

As previously mentioned, the action is not a real boring process, for the head does not rotate, the hole being formed by the displacement of the earth surrounding the head. The latter is of a special form, and is advanced against one wall of a pit sunk in the ground, the force being derived from a hydraulic cylinder, the reaction of which is taken up against the opposite wall of the pit. The large power-driven machines derive their supply of hydraulic energy from pumps driven by a prime mover—say, an 8-h.p. petrol engine. But a series of smaller and more portable appliances has been produced, for which the hydraulic power is obtained by means of hand-operated pumps.

It should be made clear that quite unlike the larger machines the small sets can undertake, on account of their special proportions, borings in much harder ground than hard clay; in fact, practically all classes of "made" ground can be dealt with, excluding, of course, rock, chalk, large stones, brick footings, concrete, &c. The hand-operated sets are primarily made for short borings and are so arranged that a greater ground displacement load per sq. in. of boring face can be applied than with the larger machines. The small sets are primarily suitable for short borings for service work, street crossings, &c. Should the ground appear to be too hard, large holes are bored by piercing initially a small one and then enlarging it in one or more subsequent operations to the final size. The nominal range, or length of hole bored, in one setting by the machines can, of course, be exceeded when working in suitable ground.

The smallest appliance requires a pit 4 ft. long by 2 ft. wide; its ram stroke is 3 ft., and the sizes of boring heads are $1\frac{3}{4}$, $2\frac{1}{2}$, and 3 in. diameter. Its over-all speed is about 60 ft. per hour, and its nominal range 40 ft.

The diagrams in fig. 1 illustrate the thrust borer in its pit ready for operation. For the purpose of aligning the appliance on the point in the receiving pit at which it is desired that the bore shall terminate, a target rod is erected over the mid point of the front edge of the receiving pit. The borer is then slung by wires from two suspension frames placed across the mouth of the boring pit and is roughly aligned on the receiving pit by altering the positions of the suspension frames and adjusting the lengths of the wires. The borer is next fixed in position by screwing out the back and front plates against the rear and front faces of the pit. The accurate alignment is then effected by applying two sighting tubes to pegs provided on the hydraulic cylinder and sighting along the tops of these tubes on to a bar placed at a

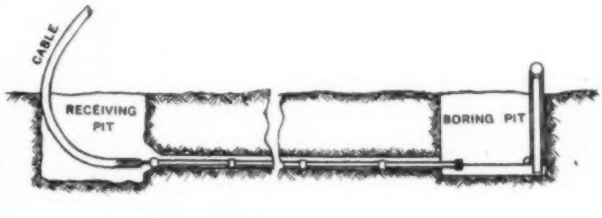


Fig. 2.—Drawing Cable into Hole.

known height on the target rod at the receiving pit. The necessary horizontal and vertical adjustment is effected by screws connecting the hydraulic cylinder to the carriage that extends between the front and back plates.

Actual boring is begun by advancing the conical-pointed rod into the ground for the full length of the stroke of the cylinder. The hydraulic piston is then run back, leaving the pilot bar in the ground, and on to its projecting rear end is slipped the full-sized cone-shaped boring head to be used. Into the head is screwed a tube, the other end of which is connected to

the hydraulic piston, and thus forms the piston rod for the next stroke, an additional length of tube being screwed on for each succeeding stroke until the pilot, followed by the boring head, emerges in the receiving pit.

To permit the withdrawal of the tubing, after the pilot and boring head have been uncoupled, to be done by power, the hydraulic cylinder is swung vertically upyards through 90 deg. (fig. 3), and fitted with a withdrawal ram, over which a rope may be led to the end of the last-inserted length of tubing, and a flexible cable or lead pipe may be drawn through the hole during the withdrawal operation, as illustrated in fig. 2. Alternatively, if a steel or iron pipe is to be accommodated in the bored hole, the pipe itself may be used as the piston rod and left in the hole, dispensing with the withdrawal operation, and thus boring the hole and laying the pipe in one operation.

Naturally, when making borings across streets in towns great care must be taken to avoid any buried pipes, cables, &c. An earthenware pipe would be broken if encountered by the boring head, but it is extremely unlikely that an electric cable or metal pipe would be damaged in any way. If in doubt, it is advisable to sink the boring pits a little deeper so as to make quite sure of being below the service obstacles. The photograph reproduced in fig. 4 is of a water service lead pipe being laid across a tar-macadam road in Rochdale, the ground being composed of dry sand and flints, and the range about 25 ft. The machine, which is in constant use in Rochdale by both the water and electricity de-

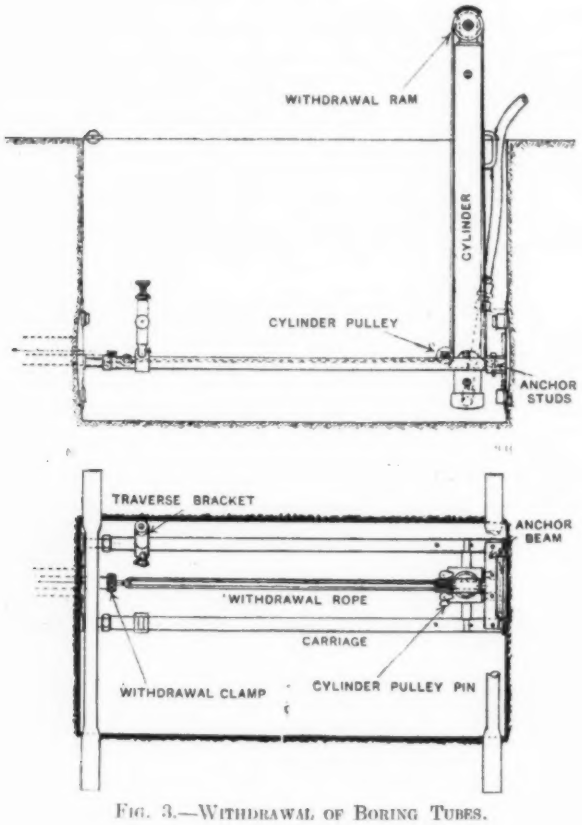


Fig. 3.—Withdrawal of Boring Tubes.

partments, is slightly smaller than the present standard (type B2) for this work, and is making a saving of from £6 to £10 per boring.

It was recently found necessary to lay an extra 3¼-in. steel-tape armoured Callender's feeder cable from a substation at one end of the Hydraulic Engineering Co.'s works at Chester to a point near the main entrance. The only route possible for the cable lay across heavily-concreted ground covered with setts, with a railway at one point. Apart from the heavy cost of cutting through this, it was undesirable from the point of view of greatly handicapping traffic inside the works. The electrical engineer of Chester accordingly had the work carried out by thrust-boring. The works yard is of considerable age, and many existing pipes, brick-wall footings, &c., had to be avoided in boring, and the nature of the ground varied considerably from clay to waterlogged "made" ground. A 5-in. hole was cut through in three lengths of about 50 ft. each, and the cable was drawn through the borings without difficulty.

Fig. 4.—Laying Lead Water Pipe.

Fig. 5.—Electric Cable Drawn through Thrust Bore.

Fig. 5 is a reproduction of a photograph that shows the cable entering the trench after having passed through the bore; the whitewash is still on the cable, and the general good condition of the fabric indicates the ease with which the cable passed through the bore. Each successive boring was made at a slight angle to the previous boring, thus forming the arc of a circle, and even this did not cause any scouring action on the bore when pulling the cable through.

The Post Office Engineering Department has employed the method to bore a number of closely adjacent holes for telephone cables beneath the Channel Sea River at Stratford, London.

MUNICIPAL ELECTRICITY WORKS COSTS.

Complete Weekly Report.

By "INTERESTED."

When preparing a weekly statement of costs for a municipal electricity supply undertaking, a certain difficulty is experienced in devising a method for including such items as establishment, overhead, and capital charges.

Often establishment charges, ascertained in the usual manner, say, monthly, can be apportioned to the numerous headings week by week on a percentage basis calculated upon wages only or wages and material combined. "Overheads," however, do not fit into such an arrangement quite so well, as the variation of output at different times of the year would seem unnecessarily to burden the costs during summer time, and unduly favour the cost per unit figure shown during times of heavy load. By making due allowance for the varying output and apportioning these charges according thereto, one can arrive at a certain sum per month, adjustable from time to time, as may prove necessary. Proportions can then be allocated weekly to the cost reports.

Capital charges may be obtained from the annual estimates, likewise adjusted in corresponding manner should fresh capital be taken up or the output fall much below, or exceed the estimate, and calculated at the rate per unit.

WORKS COST REPORT.

Week ending.....192 .

Section.	Cost. £ s. d.	Totals.	Cost per unit metered. Section.	Totals.	Remarks.
Generation.					
Coal					
Carting					
Wages					
Standing charges...					
Sundries					
Oil, waste, &c. ...					
Repairs & Maintenance.					
Engines					
Boilers					
Plant					
Buildings					
Standing charges...					
Sundries					
Distribution.					
Sub-stations ...					
Mains					
Consumers					
Standing charges ...					
Sundries					
Management.					
Chief engineers ...					
Office staff					
Town Hall... ...					
Publicity & collection					
Overhead charges.					
Rents, rates, taxes, insurance, &c.					
Special Items.					
Station					
Mains					
Totals					
Capital Charges.					
Depreciation ...					
Grand totals ...					
Hire, trading account, and public lighting					

Units to mains from works.	This year.	Last year.
Present week		
Last week		

Cost Clerk.....

Herewith is shown a form I have seen used for presenting a weekly costs summary, with provision made for inclusion of the above-mentioned items, and although it does not claim to show exactly a complete cost, it certainly does come very near that ideal, and serves more than one useful purpose. Provision is made for spreading establishment charges on a percentage basis over the various sub-headings shown; in this particular case being based on wages only. Standing overheads are included as separate items under each heading, and are based upon adjusted monthly estimates.

Another sub-heading under each of the "heads" is "Sundry Accounts," for such charges as repairs executed by contractors, &c. The right-hand side of the form is reserved for remarks by the costs clerk, who there enters notes explaining the cause for any appreciable increase shown. A copy is passed to the engineer and his three or four chief assistants, thus all are made conversant with results, and are always in a position to watch over expenditure, check extravagance or heavy expenditure directly such occurs, and not after, perhaps, a month has elapsed. By filing these sheets comparison is quickly obtained with any other period desired, and the remarks thereon allow a better grasp of facts than would be the case were no such notes available.

Electricity Commissioners' Expenses.—The Secretary of the Electricity Commissioners has issued draft rules with respect to the incidence of the Commissioners' expenses upon the parties concerned in inquiries and inspections (H.M. Stationery Office. 1d. net).

UNEMPLOYMENT INSURANCE.

By JOS. J. H. STANSFIELD.

The Government Actuary, in reporting on the financial provisions of the Unemployment Insurance Bill, estimates that the benefit payable in the 15 months ending June 30th, 1923, will exceed the contributions by £12,500,000, and that so far as can be seen at present it is unlikely that the Fund will be solvent until several years later.

The Labour Minister introduced a Bill in Parliament making provision for an increase of borrowing powers from 20 to 30 million pounds in order to relieve the present serious unemployment, and in doing so referred to the danger, through the long-continued depression, of persons claiming benefit not making a really serious endeavour to find employment, and asked for the co-operation of employers.

The possibility of effecting economies in the machinery of the present scheme is being investigated, one chief point being to examine whether it is practicable to have a single card and a single set of stamps for health and unemployment insurance instead of two cards and two sets as at present. The matter is very complicated, and, with regard to the single card in particular, the Committee has reported that it will not be practicable to bring it into use next July.

The Committee on National Expenditure made a recommendation as regards unemployment insurance by industries. Section 18 of the Unemployment Insurance Act, 1920, enables industries to set up separate schemes, but for several reasons—not least of which was the great trade depression—little advantage of this has been taken, and, owing to the large amount of unemployment benefit paid, and the consequent strain on the unemployment fund, it was decided in July last not to approve further schemes until the unemployment fund again became solvent. In view of the report of the Actuary quoted above, the promotion of further schemes will apparently be delayed for some years.

In February last the Minister of Labour sent out a circular letter outlining the problem to all the organisations of employers and employés in the country, asking for their views as to the best method of solution, and many replies have been received, considerable interest having been aroused.

Insurance on the basis of industry administration raises many questions. The small employer sometimes contends that as he has nothing but his own efforts to rely on, the individual should look after himself, but the individual worker has no direct control over many of the conditions which throw him out of work and has some justice on his side in demanding that provision be made for times of depression.

Individual employers may make provision for employés in their own works, but this possibility is limited, as is also their individual control over general trade conditions. Industries as a whole, or a particular industry, may make provision by setting aside funds or making levies on wages, but if such a method were permitted it might reasonably be contended that benefits in times of prosperity should be shared.

It is the view of many that the State should make full provision, but since the war there has been a reaction against this tendency, and in other quarters it is strongly held that as little as possible should be placed on the State.

Has the time come for the industrial community voluntarily to accept the responsibility for dealing with unemployment and for delegating in part that responsibility amongst the various industries of which it is composed?

The capitalist system, it is urged, entitles the owner of capital to take the profits because he takes all the risks. Is he taking all the risks if labour can be discharged without recompense when trade slackens? Is

not the provision for unemployment insurance a production cost like any other trading expense? If this obligation were taken, would there not be a direct incentive to get rid of unemployment altogether?

Such an important question cannot be hurriedly decided, and many details must be investigated. It must be considered whether a State contribution is necessary as at present and what State control would be required. How far can industries be grouped, and what about the "under dog?"

What are the benefits to be? Should they be small with small contributions, or large, approximating to the normal wage, with high contributions? Can employés on short time be given part benefit, and how are the workshy, the degenerate, and the mentally deficient to be dealt with?

It may be that the Investigation Committee would lead to the formation of a Parliament of Industry, and it is worth while considering whether such a Parliament could not usefully be employed in setting on foot the preliminary inquiries.

The whole question is one of deep interest, and it is significant that it is now no longer a question of insurance or no insurance, but rather a desire to provide for unemployment on the most economical terms with the hope that some new scheme can be evolved which will result in unemployment being reduced, and thereby proving that such a solution is good business.

THE INDUSTRIAL SITUATION IN RUSSIA.

[Communicated.]

One of the dominating questions at the present time among European nations is that in relation to Russia, concerning which it seems quite impossible to obtain completely trustworthy information.

Apart from reports that have been received from Genoa this week, all the news which appertains to Russia emanates from one of three sources. The first is represented by foreigners who have either worked in the country for many years, including, perhaps involuntarily, the period of the war and subsequent years, or who have recently visited the country or rather a part of the country. In the former case the information brought back may be said to be fairly reliable, because foreigners of different nationalities seem to be in agreement in their statements as to the industrial situation, while in the latter it is impossible for visitors to learn much, and in the event of their not understanding the Russian language, what they can narrate is practically of no importance whatever for obvious reasons.

The second source of information is formed by the official news agency bearing the name of Rosta, of Moscow, which circulates over the European continent daily wireless news derived from official sources and from the native newspapers. The third is the Russian newspapers themselves, and in this connection there seems no doubt that some of these newspapers, at least those whose English equivalents are the "Economic Life" and the "News" (Isvestija) of Moscow, do at times throw light on the actual situation of industrial affairs in Russia, particularly when they are quoting from and commenting on Soviet official documents.

Basing our observations on the second source of information, the first question which arises is that of the foreign trade of the country. On this point the Rosta agency circulated in the third week in March a report of the decision arrived at by the Soviet Central Executive Commission respecting the new organisation given to the foreign trade, which is now established or confirmed as a State monopoly on a wider basis than some time ago.

The administration of this State monopoly has been entrusted to the Foreign Trade Commissariat, which is now empowered to dispose of State goods in external markets and also find export markets for the products of private undertakings or of the Central Co-operative Association (Centrosojus), and the proceeds from the disposal of these products will be applied to the purchase abroad of foreign articles required by these private undertakings or the Centrosojus. At the same time, both the private undertakings and the Central Co-operative Association are to be permitted to carry on direct trade with other countries on condition that the proposed contracts are to be previously approved by the Foreign Trade Commissariat.

It is further provided that the F.T.C., in conjunction with the Council of Labour and Defence, will organise joint Russian-foreign limited companies with the object of rendering it possible for foreign capital to participate in the acquisition of export goods in Russia, in their sale abroad, and in the importation into Russia of articles required in the country. Similar companies can be formed by the State establishments on the same conditions and also under the control of the F.T.C.

It will be seen that this decision, which represents the latest decree of the Soviet Government, vests absolute powers in the F.T.C.

The Petrograd Chamber of Trade.—Just previous to the extension of the powers of the F.T.C., the Chamber of Trade (Commerce) of Petrograd, which appears to be a huge undertaking covering that province and several adjoining provinces (governments), circulated to various European newspapers a detailed statement concerning the possibilities of trading with Russia.

The Chamber points out that as a result of the recent change in the Russian political economic situation, it is now possible for the external trade of the country to develop normally. It is thus possible for the syndicates, the trusts, concession holders, &c., to enter into relations with the world's markets through the F.T.C., while foreign firms have obtained the right of working the natural resources of Russia in the form of concessions.

The Chamber further states that it has established import and export departments which are intended to facilitate relations with the rest of the world, to establish statistics of Russian production, the number of concessions and the natural resources of the country, and to form organisations in different markets to promote the export trade. It is intended to start such organisations at first in London and New York, and to open a trade register to deal with transport, insurance and Customs questions. The export department has been divided into sections representing timber and wood products, flax and hemp, porcelain, furs and carpets, engravings, &c. The import department will comprise food products, fuel, agricultural machinery, chemical products, electro-technical manufactures, metals and machinery.

The Chamber of Trade will, it says, give information to those interested.

The Return of Properties.—The new economic policy which the Soviet Government embarked upon a few months ago included the return to former owners of their properties in the form of industrial establishments or works by the grant of concessions. In other words, the former owners are permitted to take possession of their own properties under State concessions running

mostly for periods of five years, and from 10 to 25 per cent. of the production in each case has to be surrendered to the Government, apparently as rental for the concessions. The balance of the production can be freely disposed of in the home market or in the export trade.

Several thousands of concessions have already been granted to their former Russian owners in quite a number of branches of trade and industry, including the metal trades, leather, chemicals, timber, textiles, &c.

On the other hand, some of the industrial works and establishments of the same kind in one particular district have been grouped together under a single administration under the title of State trusts, or, more correctly, industrial groups. Among these there were 42 in existence in February of the present year, covering the flax industry, textiles, timber, mining, metals, paper, and the electrical industry.

The Bogy of Foreign Concessions.—During the past twelve months many rumours and reports have been circulated from Russia concerning the grant of concessions to foreign companies and other foreign interests. To the great surprise at times of some foreign firms, of which notable instances recently arose in relation to Sweden, they have learnt for the first time from Russian information that they have been granted concessions, whereas in reality they knew nothing about the matter and had not even been in negotiation with the Soviet authorities on the question.

The fact is, practically speaking, that no concessions have actually either been awarded to foreigners, been accepted by them, or are being worked by them at the present time. Under existing conditions the possession of a Russian concession is of no value whatever.

Until the safety of life can be assured and guarantees are able to be given with regard to the legal security of private property from an international point of view, it is absolutely out of the question for foreigners seriously to think of attempting to work a Russian concession; they, of course, may accept one without assuming any responsibility or liabilities in the matter if they choose.

When such guarantees are forthcoming—and they could only exist under the operation of binding treaties of commerce—it will be time enough for subjects of other nations to take into consideration the problem of working concessions. This is all the more the case, as holders of concessions are under the obligation to provide food and other necessaries for their workmen—a task which would be formidable under existing conditions.

The Question of Labour.—The labour problem is a matter of extreme difficulty to those who are carrying on Russian establishments and works.

All the best of the pre-war skilled workmen have entirely disappeared, as they have either been killed during the war and the revolution, have died of disease or famine, or have migrated from the industrial districts to the agricultural territories where there was more chance of obtaining food products.

A statement to this effect was recently made by a German engineer who a short time ago returned to his native country after a residence of many years in South Russia as manager of an industrial works. And when we learn, as has just been announced from Russian official sources, that nearly 14,000,000 persons have died through the effects of the war and the revolution and subsequent events, it seems reasonable to accept as correct the statements of the German engineer concerning the lack of skilled artisans in the South of Russia at the present time.

So great is the shortage in the industrial region of the South of Russia that the German engineer states that in the industrial restoration of Russia it will be necessary to import a large contingent of foreign mechanics and foremen in order to set things in operation.

The food problem lies at the root of the evil of the low production which prevails on all hands. It is impossible for production to be permanently increased, because if an augmentation takes place at one time, it is soon followed by a falling-off owing to the failure of the food supply. In fact, the Russians now prefer to work on the farms rather than in industrial works, as the former certainly afford better prospects of getting something to eat. Next to food comes the question of fuel, particularly coal and wood, and raw materials, of which a general shortage exists even in what were once the centres of production. In fact, production may be defined as chiefly the provision of the direct needs of the works or other industrial establishments concerned.

There is, however, one point in favour of the workmen at the present time, at all events in the region of the Ural. The work of wholesale destruction which was practised during the revolution and subsequent periods has given way in this particular region to a determination to protect property, such as still remains, from any further attempts at destruction.

According to a Swede who recently returned from the Ural, the men who were formerly employed at works which are now at a standstill owing to there being no coal and other raw materials available, have appointed committees among themselves, which take turns in watching the premises night and day, while in the case of the works which are still in operation, the task of guarding the works is being jointly undertaken by the management and the workmen.

Iron and Steel Production Insignificant.—The deplorable situation of the iron and steel industry in the greatest centre of production in pre-war times—the region of the South of Russia, including the district of the Donetz—was set forth by another German engineer who returned from that area some time ago.

Now, the Soviet official statistics show that the production of pig iron in South Russia in 1921 only amounted to 120,000 tons, whereas the quantity made in that region in 1913 was 3,046,000 tons, thus showing what a catastrophe has happened in such an important industry.

The figures relating to pig iron are merely a reflex of a similar state of affairs in the coal industry in the Donetz basin. It is imperative that the output of coal should be enormously increased if there is to be any serious talk about the industrial restoration of Russia.

Russian Foreign Trade in 1921.—A few words may be said in conclusion respecting the foreign trade of the country last year.

The "Russian Economic Life" recently published figures showing that in the nine months ended with September, 1921, the imports from England occupied the first place with a quantity of 11,590,000 poods; those from Germany had the second place with 8,216,000 poods, and the United States was third with 6,924,000 poods. On the other hand, the exports from Russia in the same period of nine months were very modest, having been 467,000 poods in the first quarter, 2,135,000 poods in the second, and 2,973,000 poods in the third.

Apart from the above statements, the Russian Foreign Trade Department in Berlin has published certain figures in relation to the trade with Germany last year. Among other matters it is mentioned that Germany exported to Russia agricultural machinery and implements of the value of 130,000,000 marks, electrical goods for 96,000,000 marks and chemical products for 75,000,000 marks in 1921.

The Russian Electrical Industry.

The electrification of Russia, according to the scheme attributed to M. Lenin, is to be carried out as far as possible and will result in the salvation of that country.

The Moscow official economic journal announced in February that at a meeting of the State Project Commission, which had just been held, the question was discussed of establishing a State bank for proceeding with the electrification of Russia. A special commission, it was said, which had investigated the problem, had reached the conclusion that the funds at the disposal of the State were inadequate for this purpose, and that the only outlet was to appeal for the assistance of private

capital both in Russia and abroad, and that in connection with this idea the plan was conceived of creating a bank in which the State, the co-operative associations, and foreign capital would participate.

It was considered, in order to induce private capital to participate, that it would be essential to offer interest at the rate of 8 per cent. on the ordinary shares and on loans for a period of 18 years in a gold currency. All payments to shareholders would be made in bank paper at the quotation of the day if the shareholders were to be free from losses as a consequence of the possible further fall in the Soviet currency. In order to guarantee the capital of the bank, it was submitted by the Project Commission that the bank must be given the right to carry out extensive transactions in merchandise. Apparently no steps have been taken as yet to deal with this side of the problem.

The commission which, as previously mentioned, was appointed to inquire into the matter of the electrification of Russia, published a report last October covering no fewer than 600 pages. Among the recommendations made by the commission with regard to the first stage of the general scheme of electrification may be mentioned the suggested erection of 30 generating stations, of which 20 would be operated by means of steam plant capable of producing 1,100,000 kW, and 10 would be hydro-electric works of a total of 640,000 kW. It was hoped in Russian circles, the commission said, that foreign capital, particularly American and German, would become interested in this the first stage of the general scheme.

German Interests and Russia.—It is known that the Germans attach great importance to the share which they hope to take in connection with the electrification of Russia, and in this direction attention may well be directed to certain statements which were made a short time ago in a Berlin contemporary by Herr M. P. Gurewitsch, an engineer of Zurich.

This engineer stated that the electrical manufacturing industry in Russia before the war had only been slightly developed, and that, too, mostly by the efforts of Russian branches of German firms. Although he does not say so, what these branches produced in Russia was only the manufactures which they did not find it desirable to import from the parent companies in Germany. As a consequence, the production of dynamos and motors in Russia only amounted to 14,300 of a combined power of 34,000 kW in 1913. But let it be noted that in the same year Germany exported to Russia electro-technical manufactures of the pre-war gold value of £17,000,000 and turbo-generators for £175,000.

The above figures are given by the engineer of Zurich. It has to be remembered that at that time there was no Herr Hugo Stinnes concerned with the German electrical industry. His interests in this respect are now represented by his association with the Siemens and Schuckert group, and one or more of his agents were recently endeavouring to negotiate business in Russia. On the other hand, there is Herr Walther Rathenau and the A.E.G. interests, which were also represented in Russia in former periods of peace, and who are declared to have M. Krassin as a supporter at the present time, although nothing appears to be known as to any present activity of the A.E.G. group in Russia.

As far as German interests in Russia are concerned, it looks as if the Russian market is to be a source of contention between these two groups unless they join forces for the general promotion of German trade with Russia; and for that matter it would be surprising if they did not co-operate for the purpose in the near future.

The Imatra Falls Again.—As to the question of generating works in Russia, it appears that there were over 250 small stations in existence in 1913 of a total of 450,000 kW, while the private installations with their own generating plant in works and other establishments numbered from 5,000 to 6,000.

At that period there was some idea of the electrical transmission of power from the Imatra Falls in Finland to Petrograd in order to afford an addition to the generating station belonging to or partly the property of Belgian interests. It is now announced from Helsingfors that the Belgian Imatra Co., which owns one of the falls in the Vuoksen, but not, as is said the Imatra Falls, has been approached by the Finnish Government with a view to the formation of a joint company with the Government of Finland for the uniform exploitation of the important falls in the Vuoksen on a common basis, that the Belgian company has expressed its readiness to co-operate in the matter, and that as it possesses electrical interests in Petrograd, the Belgian company desires that an arrangement should also be made for the transmission of power to Petrograd.

The hope is expressed in Finnish circles that it may be possible to reach an understanding in the matter of the delivery of a supply to Petrograd, but for the moment a Finnish law stands on the statute book which prohibits the export of electrical energy.

Apart from this outside aspiration, it will be seen from the brief extracts of the report of the Russian Commission that the larger part of the first stage of the general scheme, which is to occupy a period of ten years for execution, is to apply to the establishment of steam power generating stations.

But despite the use of peat as fuel to a slight extent, and of wood to a larger extent, for the production of steam, the main problem of the immediate future would appear, both for the electricity supply works and the industries of the country, to depend upon a very considerable augmentation in the output of pit coal in the great basin of the Donetz as the principal centre of production now that the Dombrova basin in former Russian Poland is no longer available to Russia.

Coal is the vital question, apart from food, upon which the whole future of Russia depends. A plentiful supply would render it possible to set the economic machinery in motion; it would permit of the production on a larger scale of iron and steel, including rails; would assist in the restoration of the railway network, the erection and equipment of electricity works and tramways, and would gradually bring Russia to the economic level which prevailed in 1913. But without an abundance of coal there would seem to be very faint hopes of the industrial resuscitation of Russia in the next few years.

BRITISH PLANT FOR NEW ZEALAND.

We have already announced the bare fact that the Metropolitan-Vickers Electrical Co., Ltd., has received from the New Zealand Government the order for generators and switchgear for the new Mangahao power station. This station forms the first of a series dotted throughout the whole of the North Island, which will finally be linked up by transmission lines, at 110,000 volts, roughly forming a ring round the southern portion of the island. A duplicate line will also be run from the centre of the system up the northern peninsula. From Mangahao station two sets of duplicate feeders will be run at present, these going respectively to the Bunnythorpe station, 2 miles distant, and to the city of Wellington, 63 miles away.

The order placed with the Metropolitan-Vickers Co. includes the supply of three 6,000-kVA and two 3,000-kVA water-wheel generators, 11,000 volts, 3-phase, 50 cycles, 0.8 power factor, driven by overhung water-wheels, with horizontal shafts, running at 375 r.p.m. Each generator will have its own direct-driven exciter, and in addition provision is being made for a stand-by motor-driven exciter set, so that when necessary the excitation of one or more generators can be transferred to the auxiliary exciter bus.

Cooling air for the generators will be drawn through a separate ventilation tunnel, circulation being maintained partly by a separate blower, and partly by the usual fans on the rotor, the blower being designed to maintain two inches pressure. The generators are designed for an overspeed of 80 per cent., and will have a regulation of 27 per cent. at 0.8 power factor. Provision will be made for sliding the stators, so as to facilitate access to the rotor when necessary for inspection and cleaning work.

The current from the generators will be taken through automatic oil switches of the Metropolitan-Vickers "HF2" type, through selector switches to duplicate 11,000-volt bus-bars. Both bus-bars will be sectionalised in the middle, and this sectionalising is carried out correspondingly on the 110,000-volt bus, so that the whole system can, if necessary,

be split into two entirely independent portions. From the generated-voltage bus-bars, supply will be taken through two 12,000-kVA transformer banks to the 110,000-volt bus-bars, and thence to the four outgoing 110-kW feeders. There will be four local feeders at 11,000 volts. The 11,000-volt equipment will be mounted in a conventional moulded stone cubicle structure. The e.h.p. switches for controlling the transformer circuits will be indoors, while the isolating switches, oil circuit-breakers and lightning arresters for the feeder circuits will be accommodated on the roof of the power station. In this way the total ground space occupied is kept down to a minimum.

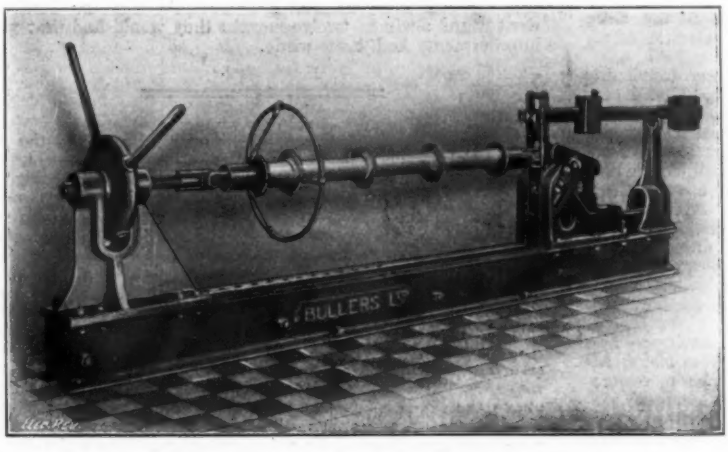
Each generator and transformer unit will be protected by the usual circulating-current system, while on the 110,000-volt feeders there will be fitted the new Metropolitan-Vickers compensated overload relay, which is designed to give an inverse operating time characteristic with a definite adjustable minimum. In addition the pairs of feeders will be protected by balanced, biased relays, which will operate in the event of the failure or short-circuiting of either feeder.

This order marks a definite period in the history of switchgear development in this country, in that it is the first placed for British-built material, for so high a voltage. We have already referred in our columns to the developments which the Metropolitan-Vickers Co. is making in this direction, and at a later date we hope to publish more complete details of the scheme now referred to.

AERIAL INSULATORS FOR WIRELESS TELEGRAPHY.

As a consequence of the revolutionary developments which have taken place in wireless communication in recent years, and the erection of wireless stations on lines far exceeding both in power and dimension the earlier efforts of the pioneer wireless engineers, it has been found necessary to reconsider the principles underlying the design of suitable insulators. The advent of structures of the order of seven and eight hundred feet in height has resulted in a necessity for insulators with properties, both mechanical and electrical, which far exceed those with which engineers generally are acquainted.

The general construction of wireless aerials embodies in most cases the use of triatic stays, from which the aerial conductors themselves are suspended. It is well known that porcelain has properties which make it the most suitable material for the insulation of aerial conductors, both for transmission line work and also for radio frequencies. Porcelain withstands heat, and, if properly made, has very great mechanical strength. Synthetic substances and compounds are not usually capable of withstanding high temperatures, and their surfaces are affected when used under high-frequency conditions.



An Aerial Insulator for Wireless Telegraphy under Test.

For many years it has been considered that when it is necessary to apply mechanical stress to porcelain, this should be done in such a manner that the material is only under compression. This has been a great handicap to the insulator designer, in that he is limited to such designs as the well-known "goose egg" or the Hewlett types. Neither of these designs is suitable for aerial insulation at radio frequencies; for one thing their capacity is relatively high, owing to the close proximity of the electrodes. Rubber-covered rope strops and synthetic substances, of which the strength in tension is good, have been tried, but the increasing use of continuous-wave telegraphy has shown that they will not stand up to the continuous high-frequency discharge which inevitably passes over their surfaces when in a wet condition. It has been found that the discharge burns their surfaces and very quickly destroys their insulating and mechanical properties. For some years small porcelain rods have been used in tension for light aerial loads with considerable success, their surfaces being unaffected by the conditions of working. These, however, are limited to comparatively light loads, and therefore it was incumbent upon porcelain insulator manufacturers to turn their attention to a design of insulator which would embody the three important properties of low capacity, high insulating value, and ability to bear very high tensile loads. The aerial insulator, shown in the accompanying illustration, is claimed to combine these three qualities.

The overall length of this insulator is 5 ft. 10 in., and its weight is 87 lb. It has very low capacity—0.000002 microfarad (approx.). In a tensile load proof test it withstands 10,000 lb. Its spark-over voltage, when dry, is 450 kV, r.m.s. (approx.) at 100 cycles; and, under rain, 220 kV, r.m.s. (approx.), at 100 cycles. The insulator is also unpuncturable.

An interesting feature in connection with this insulator is the testing machine, which is also illustrated. This was specially designed for the purpose of testing heavy-load aerial insulators, and, incidentally, to take simultaneous electro-mechanical tests on other types of insulator. Both the design and the manufacture of this machine were carried out by the porcelain manufacturers themselves.

The fittings shown on the insulator are all of galvanised malleable cast iron and steel, and the insulator is provided with flux distribution rings at either or both ends.

This insulator is the largest of its type to be made in England, and it may be justly claimed that it is somewhat of a triumph for the British porcelain industry.

The insulator has been developed by Messrs. C. F. Elwell, Ltd., wireless contractors, in conjunction with Messrs. Bullers, Ltd., the manufacturers, who are responsible for the design, dimensions, &c.

We are informed that this type of insulator is being employed in connection with the Imperial Wireless Chain, and has already been installed at Leafield and Northolt.

INDUSTRIAL RESEARCH.

The several researches undertaken by the British Electrical and Allied Industries Research Association are now reaching the stage at which a number of reports and technical publications can be announced, and several more will shortly be available. The publications on insulating materials include one giving instructions for the study of untreated papers for purposes other than cable manufacture. A full account of the researches on which these instructions are based is also to be published. In addition there are similar reports upon the mechanical and physical testing of pressboards, pressspahn, &c., and on vulcanised fibres. The electrical testing of fibrous insulating materials is covered comprehensively by another publication; the scope of the research on electrical tests of all these materials is being extended to include standardised methods suitable for all insulating materials. Sheets, rods and tubes of composite insulating materials are dealt with in another publication. The researches upon which this is based have already proved of great value to the co-operating manufacturers, and marked improvements in their products are reported. A full account of these researches will shortly be issued. Work on the composite class of insulators (still under consideration) includes the evolution of test methods for fire and heat-resisting properties, the practical application of these methods to materials on the market, and work on moulding properties and on the action of solvents and hot oil.

The committee on synthetic resins has prepared a technical publication giving directions for the study of synthetic resin varnish-paper and varnish-fabric boards, and also reports on the possibility of establishing and safeguarding in this country the manufacture of raw materials for these resins. Other work in this section includes a report on the requirements of Government departments with reference to synthetic resin products and tests upon moulded products. Samples of varnish-paper and varnish-fabric boards, and of moulded products are being collected.

The use of mica for condensers and commutators is the subject of a report issued by the committee on mica and micanite. The report deals with the classification, identification, and properties of mica; investigations are still proceeding on the mechanical and electrical tests of various kinds of

mica. Steps have been taken to clear up the existing confusion in the classification, manufacture and use of micanite by bringing in close touch all parties interested in this material.

The researches on the electrical strength and resistivity, and on the thermal properties of insulating oils are progressing. The former are to be carried out in close co-operation with Professor J. A. Fleming at London University, where a programme of research has been mapped out. In addition to these specialised researches on insulating materials the general researches on dielectrics are being actively pursued. New work in this direction includes an investigation of the cathode ray tube as an instrument for the measurement of dielectric losses at high frequencies, and an examination of these losses at high voltages by the use of an electrostatic wattmeter.

Three reports are in preparation in the section dealing with conductors. The first will clear up outstanding points on the heating of buried cables, except dielectric loss problems; the second report will suggest material improvements arising out of tests on standard wood poles for overhead lines. The third report in this section will treat with test results obtained on long overhead copper cables; the work on aluminium and steel cables is nearing completion.

Several valuable researches, on a practical scale, are progressing in connection with electrical control apparatus. These include tests on oil circuit breakers (for which the 6,000-kW alternator has now been prepared and its characteristics determined), on mining switchgear, fusible cut-outs, and air circuit breakers for d.c. This last research has the practical co-operation of the London County Council and the London and North-Western Railway Co., Ltd. A forthcoming paper by the National Physical Laboratory is also announced, giving the results of tests on the conductivity of joints in copper and aluminium bars.

Recent researches on stainless steel have necessitated a revision of the programme previously mapped out for research on turbine blading. Good progress is reported in the tests on turbine nozzles at Manchester University. It is interesting to learn that Professor Callendar is undertaking researches on turbines and on the properties of high-pressure and high-temperature steam. Amongst the miscellaneous researches and new inquiries undertaken by the Association may be noted: tests on the relation of the permissible variations of supply voltage to "flicker" of incandescent lamps, conferences with Government departments on accumulators and batteries, and researches on the wave-form of generators. A full review of the progress of all the activities of the Association may be found in the Quarterly Progress Report for April.

A VISIT TO THE CEAG WORKS.

The members of the Midland Institute of Mining, Civil, and Mechanical Engineers visited the works of the Ceag Miners' Supply Co., Ltd., manufacturers of electric safety lamps, Barnsley, on April 8th.

The party was received by Mr. R. J. Plummer (managing director), and Mr. J. Grierson (general manager), and conducted over the extensive and well-appointed works. The Ceag Co. was originally German, with works at Dortmund, but Mr. Plummer purchased the whole of the shares from the Public Trustee, and formed a limited company which is entirely British. About 300 collieries now use the Ceag, and the total number supplied to date is 500,000. The Barnsley works has been established three years, and is still extending. Some 200 people are there employed on the manufacture of lamps and accessories, and the output capacity is 700 lamps per day. Including the firm's other works, where the battery plates are manufactured, the total number of employés is 500.

The departments at Barnsley include the following:—Two large assembly shops, two machine shops, press shop, accumulator shops, charging stand shops, tinning shop, electroplating shop, laboratory, and tool room. The company devotes its whole energies to the manufacture and improvement of the "Ceag" lamp. Very striking features noticed during the tour of the works were the methods employed by the company to ensure accuracy of production, all articles being made to gauges and jigs, and afterwards submitted to very close inspection. Many special-purpose tools are in use, differing very considerably from standard productions. These tools have been designed and manufactured in the company's own works. The company manufactures all its own dies and tools, and is quite independent of outside sources of supply. The material used for the making of the lamp cases is mild steel, which is received in the form of tubes, out of which the cases are cut. The head and bottom of the lamp are pressed, and the bottom is electrically welded on. The cases and tops are all tinned, the tinning not merely adding to the appearance of the lamp, but also giving a protective coating. In some cases the parts are notashed after tinning, in order to get rid of any free acid which might be left about, and which would get under the joints.

The works includes a well-equipped laboratory where all electrical and mechanical tests can be undertaken, and many very interesting tests were in hand at the time of the visit. Every bulb is tested against a standard bulb, in order to compare the light given. Lamps are also tested in batches, and some of these, which the visitors inspected, showed very clearly the differences that exist between lamps, and the necessity for the standardisation of bulbs. These batches are tested to destruction, under working conditions, being allowed to run a shift of eight hours, and then having an interval of eight minutes before starting the next shift. The average life of a good bulb is between 500 and 600 hours. Another feature of the laboratory is the polariscope, for discovering strains in the bulb glasses. These strains are shown by colour lines, tension being signified by red and compression by green or blue. All the "Ceag" glasses are tested for glass strain, and any which are bad are promptly rejected.

In the office were on view examples of all the various kinds of lamps made by the company. These included two or three kinds of standard lamps; a special lamp for signalling, showing red, white, and green lights; a special lamp with swing reflector; a cap lamp, which will run for twelve hours continuously; a shaft or sinking lamp; an officials' small lamp; and an electric torch. The standard lamps, fitted with standard accumulators, give about 12 s.p., and will burn for ten hours.

The inspection of the works was followed by luncheon, at the invitation of the directors of the Ceag Co. Mr. R. J. Plummer (managing director) presided, and was supported by Mr. C. A. Longbottom (director), Lieut.-Col. Rhodes (president of the Institute), Mr. J. H. W. Laverick (ex-president), Mr. E. J. Foley (Director of Health and Welfare, Mines Department), Prof. Wheeler, and others.

Colonel Rhodes, expressing the indebtedness of the Institute to the directors of the company, said his experience of the electric miner's lamp went back a long way. He remembered Mr. Fleuss coming round with his device about 1884, and also the appliance of Messrs. Swan & Pitkin, in 1888 and 1889. So far as the lamp whose manufacture they had seen that day was concerned, he remembered very well when, in 1912, the late Sir Arthur Markham offered his prize for the best electric safety lamp, and the "Ceag" was awarded the first prize. It was very gratifying to know that the lamp they bought was, to a great extent, being manufactured by the people who sold it. He wished they could always say the same about the things that they bought.

Mr. Plummer, in reply, said it had been a pleasure and honour to have such an august body visiting the works that day. They did endeavour to give pains, care, and attention to the making of every part of the lamp. The visitors had seen the jigs and gauges that were used, in order to ensure having a perfect article, as nearly as possible.

Mr. C. A. Longbottom, in seconding the welcome which Mr. Plummer had given to the visitors, spoke of the improvements that had been made in the works since the company took it over. He added that they were now starting a research department, and if the members of the Institute went round again in twelve months they would find that vast improvements had been made.

B.T.H. "Trutint" Lighting.—Those who visited the recent Ideal Home Exhibition at the Olympia and the Royal Gardens, in the annexe, no doubt noticed that there was no distortion of colour values, such as one might expect under artificial light. The flowers and foliage looked exactly as they ought to look in a sunny open-air garden. The explanation is to be found in our first article on the show, namely, B.T.H. "Trutint" lamps were used to light the gardens—sixty of them—each equipped with a 1,000-watt Mazda gas-filled lamp. Essentially this unit consists of a Mazdalux metal reflector, over the mouth of which is fitted a special screen. All the light from the Mazda lamp has to pass through this screen, which absorbs a large proportion of the red and yellow rays. At Olympia the "Trutint" units were suspended well above the line of sight, and the general effect was strikingly like that of diffused sunlight. One very interesting phenomenon was observed in this connection. When the lights were switched out at night the hundreds of tulips in the gardens, with one accord, closed up their petals. And with the same simple and simultaneous faith they all opened again as soon as the light was switched on. This fact, although, of course, quite in accordance with horticultural theory, formed a remarkable and entirely unsolicited testimonial to the effectiveness of "Trutint" lighting.

£5,000 for X-ray Work.—The Board of Management of the Manchester Royal Infirmary states that Mr. Robert McDougall has intimated his desire to defray the entire cost—£5,000—of equipping a Radiological Department at the infirmary as a memorial to his father, the late Mr. Arthur McDougall.—*The Times.*

Swedish Electrical Dispute Settled.—The preliminary agreement in the electrical industry has been ratified by both parties. The agreement involves reductions in wages amounting by stages to 33 per cent.—*Reuter's Trade Service* (Stockholm).

SOUTH-EAST LANCASHIRE ELECTRICITY DISTRICT.

THE ELECTRICITY COMMISSIONERS' DECISION.

THE Electricity Commissioners have considered the evidence given at the inquiry held by them in January last at Manchester* into (a) the scheme submitted by the Conference of Authorised Undertakers in the above-named district for the establishment of a South-East Lancashire Electricity Board, and (b) the representations made to them by various bodies for the inclusion in, or exclusion from, the district of their respective areas. The authorities in the district (Salford and Stretford excepted) were unanimously opposed to the formation of a Joint Electricity Authority, and emphasised their view that an Advisory Board should be set up.

The Commissioners entertain some doubt whether the provisions by which the Advisory Board will make representations to constituent authorities with a right of appeal to the Commissioners will enable sufficiently comprehensive works to be undertaken. They apprehend that there may be a tendency to proceed by piecemeal extensions of stations and interconnecting lines at an ultimate increased cost to the constituent authorities and the consumers concerned. An advisory board may also experience difficulty in securing supplies in unoccupied areas, more especially in those contained in the enlarged district south of the Manchester Ship Canal, for which a Joint Electricity Authority would be empowered to make provision.

In view, however, of the unanimous support given to the scheme by the authorised undertakers, both local authority and company, and of their strong opinion that this voluntary arrangement is the best the Commissioners are prepared to make an order embodying the arrangements which the constituent authorities have agreed to carry out, as set forth in the administrative scheme † (as amended in the course of the inquiry), and in the technical particulars submitted by the Conference.

The Commissioners confirm the area provisionally determined ‡ subject to the following amendments:

The exclusion of the urban districts of Lymm (Cheshire), and Haydock (Lancashire), both of which are now included in the Mersey and West Lancashire Electricity District.

The inclusion of the urban district of Adlington, inadvertently omitted from the notice of provisional determination and from the published map; and the inclusion of the municipal boroughs of Buxton and Macclesfield, the urban districts of Bollington, New Mills, and Yeardsley-cum-Whaley, the rural districts of Macclesfield, Hayfield, and Disley, and the parishes of Chapel-en-le-Frith, Chinley, Bugsworth and Brownside, Fermlee, Green-Fairfield, Hartington-upper-Quarter, Kingsterdale, Peakforest and Wormhill.

The title "South-East Lancashire Electricity Board" is liable to be misinterpreted, and a more appropriate title would be "South-East Lancashire Electricity Advisory Board."

The number of representatives on the Board is unnecessarily large. If the authorities in the district are unwilling to reduce the size of the Board, the Commissioners, having regard to the agreement arrived at between the constituent authorities, will be prepared to include in their Order the proposal submitted in the second schedule to the amended scheme subject to certain modifications consequent upon the agreed representation of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, and upon the increased area of the Electricity District. It is unnecessary that county councils should be represented on the Advisory Board.

The engineer of the Stalybridge, &c., Electricity Board should be a member of the Engineering Advisory Committee, but having regard to the non-standard frequency of the Stalybridge system, he should be entitled only to attend the meetings of the Committee when electrical developments and proposals are to be considered which may affect the area of the Stalybridge, &c., Electricity Board, and the areas contiguous thereto.

The agreed provisions for contribution to the administrative expenses of the Board are approved.

The Yorkshire Electric Power Co. will not be required to furnish plans of new works to the Board, but only to furnish such statistics as may refer to supplies given by the power company within the urban districts of Saddlesworth and Springhead.

The Order will include provision for the submission by the Board of an annual report to the Commissioners.

The Commissioners approve generally the technical scheme, subject to a provision that modifications thereof may hereafter be made with the approval of the Commissioners.

The actual direction of the times and method of working inter-connected stations so as to produce the most economical results will be best effected by an officer of the Board appointed for that purpose who would carry out the programme of working laid down by the Engineering Advisory Committee and approved by the Board; a scheme of control of generating stations following the above-mentioned lines should be framed by the Board and submitted for the approval of the Commissioners.

The Board, within two years from the date of its establishment, will be required to submit proposals for securing a supply in areas within the district which are not at that date within the areas of supply of authorised distributors, and in which there is a reasonable prospect of such supply being remunerative.

The observations of the Conference will be invited on the clauses of the draft Order before the Commissioners hold the further inquiry required by Section 5 (4) of the Electricity (Supply) Act, 1919.

* ELEC. REV., January 20th, 1922; p. 97.

† ELEC. REV., September 30th, 1921, p. 454, and November 4th, 1921, p. 596.

‡ ELEC. REV., June 25th, 1920; p. 815.

LEGAL.

A MUNICIPAL CANDIDATE'S ELECTRICITY.

AN unpaid electricity account for £2 5s. 2d. was responsible for a very unusual application by the Blackpool Corporation at the local County Court against Mr. James Kay, a candidate at the November municipal elections. The Deputy Town Clerk said that the application of the Corporation was that an account, amounting to £2 5s. 2d., for electricity supplied, might be allowed to be sent in and paid by the respondent, as provided by the Municipal Elections (Corrupt and Illegal Practices) Act of 1884. Mr. Kay was a candidate at the November municipal election, and his committee room was supplied by the Corporation with electricity. The Act provided that all expenses incurred by him had to be paid within 21 days, and that the County Court might, on the application either of the candidate or of a creditor, allow any claim to be sent in or any expenses to be paid after the time fixed by the Act. Mr. Kay had paid all his other bills and made a return to the Town Clerk, but he had omitted to pay this account. It had apparently been done without any intention to evade payment, and he presumed it was forgetfulness, although, as a matter of fact, there was sent to each candidate, after the election day, a copy of the section of the Act, telling him the various things he had to do. Respondent had neglected to get in that account, although among the accounts paid there was one relating to electrical fittings for the committee room and the hire of an electric stove. He asked that the account might be sent in and paid by Mr. Kay. The application was granted.

BOYS' FOOLISH ACT.

AT the Dudley Children's Court, on April 12th, Albert Hicks (13), and Reginald Aston (13), were charged with doing wilful damage to the extent of £900 to property belonging to Messrs. W. Goodyear & Sons, Ltd. Mr. F. W. Green, who prosecuted, explained that the firm had a private railway from the works down to the Great Western line in Shaw Road. It was worked by an overhead electric cable, the cable being fed from a switch in the hollow of the siding, some 150 yards from the highway. On April 1st the electric tram attached to the railway trucks was left some distance from the top of the incline, inside the works, and the power was switched off at the main. The charge against the boys was that they switched on the power, uncoupled the train, and operated the levers with the aid of a spanner they found in the tram. The boys were then on the tram, which began to move down the incline, and, finding they could not stop it, they jumped off, thus saving their lives. The tram ran down the incline, crashed into a truck at the bottom, and did a great deal of damage. It was stated that the gradient was 1 in 15.

An employé said the main switch would have to be operated before the tram would move. The switch-box was half-way down the incline, and was not kept locked.

The presiding magistrate said it was a very wicked thing to do, and many lives might have been lost. Aston was discharged and Hicks was ordered to receive six strokes with the birch.

A Westminster War Memorial.—On April 12th the chairman of the Westminster Electric Supply Corporation, Ltd., unveiled a war memorial to the memory of employés of the company. Capt. E. I. Bax said that the tablet was erected in memory of heroes who laid down their lives in defence of their country, and it would serve to recall their memories, not only to us, but would also preserve them for posterity. He said that they did not forget those who placed their lives in the same hazard and had returned among them. In placing the wreath in the name of the Westminster Electric Supply Corporation, he saluted the memory of the departed.

PARLIAMENTARY NOTES.

(By our Parliamentary Reporter.)

Yorkshire Electric Power Bill.—On Tuesday, April 11th, a Bill which seeks to confer further powers on the Yorkshire Electric Power Co. came before the Unopposed Bills Committee of the House of Lords. The Bill provides for the conversion of the capital of the company into 2,000,000 shares of £1 each—the existing £10 ordinaries each into ten £1 ordinaries, and the £5 preferences each into five £1 preferences; and provides for arrangements in connection therewith. Power is also taken for the issue of additional capital, and for a number of domestic matters connected with the administration of the undertaking. It is proposed by a special additional provision to increase the capital of the company from £2,000,000 to £4,000,000 to provide for the ordinary development of the company and for developments in accordance with suggestions of the Electricity Commissioners following local inquiries.

Formal evidence was given, and the Bill was passed for third reading.

Electricity in Agriculture.—Sir A. Griffith-Boscawen, the Minister of Agriculture, replying to a question asked in the House of Commons by Mr. A. T. Davies on April 11th, said that the Ministry was closely observing developments in the application of electricity to agriculture. A Committee dealing with electroculture had been in existence for four years, and under its direction a great deal of experimental work had been done. The chairman of the Commission was Sir John Snell, and among its members were the leaders of several branches of electrical and agricultural science. Progress was necessarily slow in a question so complex and difficult, but the work of the Committee had now reached a stage where experiments were being conducted on an economic scale. So far as concerned the application of electricity to stationary machinery and lighting, a good deal of progress had been made in several parts of the country. The Ministry was in close touch with a gentleman who was applying electricity to a large farm, and it had the benefit of the data derived from his experiments. Some of his results had already been published, and the Ministry had arranged for them to be summarised and published in the Ministry's *Journal* for the benefit of farmers in general. At the same time, it was desirable to say that the development of the uses of electricity in farming must largely depend on the extension of power stations and cable services, and the utilisation of natural sources of power.

The Electricity (Supply) Bill.—The Electricity (Supply) Bill, which was read the third time and passed in the House of Lords on April 12th, was read a first time in the House of Commons on the same day.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Lock-out.

I am a regular reader of the Electrical Review, and referring to a letter on "The Lock-out," by "An Electrical Manufacturer," I beg to point out to him the fact that trade unions came into being chiefly as a safeguard and also a preventative against inhumane and selfish, feudalistic treatment of the working classes by the master man. Personally, I think and know that the majority of union men concerned are of the same opinion.

If a speedy settlement is the common desideratum it can only be realised by insisting on the withdrawal of Sir Allan Smith.

He is the Jonah of the conference; if he is not cast out the ship will sink (*i.e.*, industry), with masters and men alike.

Why not Sir Robert Hadfield, Bart., in his place?—a thorough gentleman and eminent manufacturer, honoured as such by every trade unionist.

Sir Allan Smith is only imbuing hatred for himself and similar men in the rank and file.

The British workman is the finest in the world, if treated fairly, at the same time remembering that many have not had the chance of a good education and, therefore, have become pawns in the game of life. There are good and bad men of education existing in all sections of the industry; unfortunately they take advantage of this and sway the men how they will.

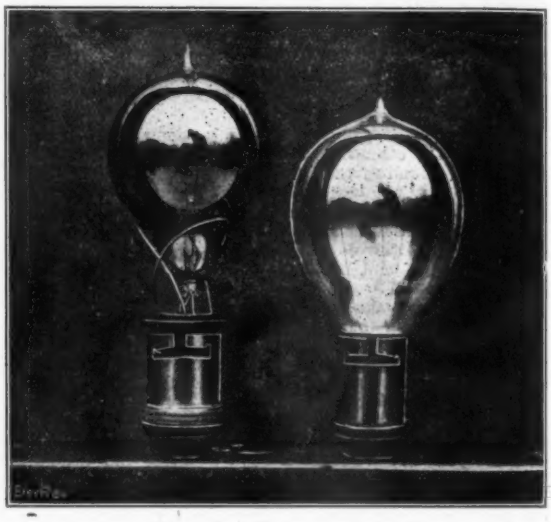
George Heasman,
Electrician.

Eltham,
April 16th, 1922.

Early Lampholder Patents.

Under the heading of "New Electrical Devices," I notice a description of the "Onoroff" lampholder, which might lead your readers to infer that the idea underlying the design is entirely novel. This is far from being the case, as you will see from the photograph which I enclose of lampholders in my collection which were on the market about thirty-five years ago.

The bayonet-cap lampholder was introduced in the "eighties," the Dornfeld patent under which it was manufactured being dated January, 1884. At first the lamp caps were short brass tubes filled with plaster of paris, having two brass contacts embedded in the plaster. This was improved upon by Mr. Alfred Swan (a brother of Sir Joseph Swan) who conceived the idea of making the cap of black pressed glass, which he called "Vitrite," with the metal contacts cast in. He established the Vitrite Works, at Gateshead, and proceeded to apply the method to the manufacture of lampholders as well as caps. The photograph shows two patterns of Vitrite lampholders, the one on the right being the earlier in date. In both holders the brass tube has two pips projecting inwards which engage with bayonet joint grooves formed in the Vitrite base. In the holder on the right the springiness of the split brass tube is relied upon to keep it in place, but the one on the left has a screwed ring which can be forced on to the base, thus fixing the



relative positions of base and tube. Both bases have screwed brass nipples, and terminals which carry the spring piston contacts, cast into the Vitrite. It is interesting to note that the lamp cap shown has the pins engaging the bayonet slots formed of the Vitrite itself, though later patterns have brass pins cast in. The lamp shown on the left is one having platinum loop contacts and is carried in an "Adapter," which was introduced to tide over the transition stage between loop lamps and capped lamps. The surface of the Vitrite cap was so hard and smooth, as compared with the plaster-filled cap, that it soon occurred to me that a form of cheap switch lampholder could be produced by having a bayonet-joint slot extending on both sides of the opening. I visited Mr. Swan at his works and made the suggestion to him, with the result that he immediately put it into practice, and placed on the market the holders shown above. Owing to the brittleness of the Vitrite the holders were not much of a success, but brass caps with Vitrite faces having the contact plates cast in have survived, and are now used almost universally for bayonet-capped lamps.

J. H. Holmes.

Newcastle-upon-Tyne,
April 15th, 1922.

Dundee and the German Quotation for Cable.

I am sorry to note from your issue, of April 7th, that Dundee Corporation has placed an order with a German cable manufacturer at a price 10 per cent. lower than the nearest British offer. (So Germany did win the war after all!) I am more sorry to note that Mr. H. Richardson, the engineer, "pointed out that if they let it go out that they were shutting the door to Continental tenderers it would mean the payment of scores of thousands more in the future."

Mr. Richardson evidently wants to convey to his committee that there is no competition by cable manufacturers of this country. If he thinks so, he is wrong. From the published figures of cable "tenders accepted," I can tell him that for some types, cable makers quite evidently, often sell either at very little over cost, at cost, or below cost, because of internal competition.

Perhaps Mr. Richardson would like to see electric cable manufacture in this country reduced to that stage of com-

petition when it would be difficult to get a reliable cable, and when all cable workers and staff would be abominably sweated. As an employé in the cable industry, I want to get a reasonable living. Mr. Richardson wants to reduce me below the level of the German worker.

I suppose Mr. Richardson is still a member of the Associated Municipal Electrical Engineers of Great Britain and Ireland, which fixes, on a very high plane, the scale of salary on which municipal electrical engineers should be paid. If he is a member, he should resign at once, if he wishes to be consistent.

The cable makers of this country might very conceivably obtain their supplies of jute yarn from Germany, at a lower price than from Dundee. This might not ultimately benefit the cable makers, but it would be unfortunate for Dundee.

The great pity is that, as Germany has put the world in its present chaotic condition, Mr. Richardson thinks it necessary for him to hasten to do his bit to help Germany get on her legs first, and as soon as possible.

Othello.

April 13th, 1922.

Rats v. C.T.S.

Many silly advertisements have been inflicted upon us with reference to the above system of wiring, apparently with the idea of making the contractor smile, thereby ensuring an order. The advertisement appearing under the above heading in the Electrical Review, of April 14th, has no suspicion of humour in its composition; as a matter of fact one can scarcely credit any firm stooping to such methods to boost business.

The whole affair can only be described as fiendishly cruel.

This letter is not written by anyone interested in any rival system, but by just an ordinary contractor who signs himself—

Completely Disgusted.

April 13th, 1922.

It was with feelings of disgust that, on looking through your valued journal to-day, I came across an advertisement, *re* C.T.S. Surely the firm in question are not so hard driven to obtain business that they are compelled to revert to the practice of starving a rat to prove their contention that this class of cable is "ratproof?"

The mere fact of imprisoning a rat, to secure evidence, is, to my mind, a form of cruelty, which I sincerely hope will be investigated by the R.S.P.C.A.

Some months ago, during a lecture on the good and bad points of C.T.S., by one of this firm's representatives, a case was cited where rats on a whaler were responsible for destroying a considerable amount of this cable, while the vessel was being reconditioned. I am not sure, but believe the ship in question came from South Georgia. Be that as it may, the torturing by a responsible firm of a dumb creature for the purpose of filthy lucre is a disgrace, and should not be tolerated by any decent-minded person.

By all means destroy rats, but do not inflict torture, for what is purely an advertising stunt.

Disgusted.

April 15th, 1922.

[It is hardly necessary to say that we sympathise with the feelings of both of our correspondents.—Eds. Elec. Rev.]

BUSINESS NOTES.

Bankruptcy Proceedings.—Charles Godolphin Bennett, 66, Mark Lane, E.C.—An application was made last week to Mr. Registrar Hope at the London Bankruptcy Court for approval to a scheme for the payment of a composition of 7s. 6d. in the £. The Official Receiver reported that the debtor failed in December, 1921, with liabilities £1,422 and assets valued at £103. He was a commission agent carrying on business as Bennett Bros. In March, 1916, he became associated with another person in experimenting with and putting on the market an electric switchholder, and he financed the project to the extent of £2,000. The failure was attributed to lack of capital and to a total loss of £2,847 sustained in connection with the electric switchholder. The Official Receiver further reported that proofs to the amount of £214 had been withdrawn, and another proof for £267 would not be pressed, as the creditor was willing to rely upon the security he had in hand. His Honour agreed that the terms of the composition were reasonable and calculated to benefit the creditors; he ordered the scheme to be approved and the receiving order rescinded.

J. F. Ludlow and R. R. Ludlow (trading in co-partnership as Ludlow Bros., electrical contractors, 196, Church Road, Redfield, Bristol). The following are creditors herein :—

	£		£
English Electric & Siemens Supplies, Ltd.	57	Siemens Bros. & Co., Ltd.	40
Edison Swan Electric Co., Ltd.	35	Rose Bros.	21
Elco Electric Manufacturing Co., Ltd.	22	Simpson, Baker & Co.	53
		Shafford, C. H.	53

Frank Rawcliffe, electrical engineer (Frank Rawcliffe and Co.), 8, Nun Street, Newcastle-on-Tyne.—The first meeting of the creditors was held on April 11th at the Official Receiver's office, Pearl Buildings, 4, Northumberland Street, Newcastle-on-Tyne. The statement of affairs showed liabilities of £3,866, against assets of £11. The Official Receiver stated that a limited company had been formed in August, 1921, to take over the liabilities. This company was now in voluntary liquidation, and there had been a suggestion of a payment of 10s. in the £ by means of debentures, liquidated every three months. Debtor stated that the whole of the creditors could claim against the limited company and get 10s. in the £. The meeting was adjourned.

F. S. Ormonde (carrying on business in partnership with another as the Soho Electrical Works), electrician, 125, Islington, Liverpool.—Receiving order made April 8th on debtor's own petition.

E. Cookson (W. Turnbull & Co.), automobile, electrical, and mechanical engineer, Express Magneto Repair Works, Elizabeth Street and Charles Street, Blackpool.—First meeting April 20th at the Official Receiver's offices, Preston. Public examination, April 21st, at the Court House, Blackpool.

S. Holmes (Holmes & Co.), electrical contractor, Palatine Chambers, Halifax.—Receiving order made April 11th on debtor's own petition. First meeting April 28th. Public examination May 19th, both at the County Court, Halifax.

A. Vivian, electrical engineer, 180, Gray's Inn Road, W.C.—Receiving order made April 10th on creditor's petition. First meeting April 26th. Public examination June 20th, both at Carey Street, W.C.

Company Liquidations.—Howard Pneumatic Engineering Co., Ltd.—A petition for the winding-up has been presented to the High Court by W. Gowland (Gowland Bros.), Eastbourne, and will be heard in London on April 25th.

Bishops Castle Electric Light and Power Co., Ltd.—A petition for the winding-up has been presented to the County Court of Hereford by the Premier Accumulator Co. (1921), Ltd., of Northampton, and will be heard at the County Court, Leominster, on May 8th.

J. T. Callaghan & Co.—Winding up voluntarily. Liquidator: Mr. W. Eaves, 15, Fountain Street, Manchester.

B.E. Co. (of London and Birmingham), Ltd.—Particulars of claims had to be sent to the liquidator, Mr. F. Rowland, 70, Queen Victoria Street, E.C., by April 20th.

Codes, Ltd.—Meeting May 17th at 24/25, Fenchurch Street, E.C., to hear an account of the winding-up from the liquidator, Mr. J. W. Starkey.

National Electric Supply Co., Ltd.—Winding up voluntarily, owing to the sale of the undertaking to the Preston Corporation. Liquidator: Mr. W. H. Ainsworth, 11, Winckley Street, Preston. Meeting April 25th.

E. O. F. Syndicate, Ltd.—Meeting of members May 19th at 20, Lawrence Lane, E.C.2, to hear an account of the winding-up from the liquidator, Mr. A. N. Stockdale.

Nunn Ridsdale & Co., Ltd.—At an extraordinary general meeting, held on April 4th, it was decided that the company, by reason of its liabilities, is unable to continue business, and that it is advisable to wind it up. Mr. W. B. Taylor, chairman.

Dissolutions of Partnership.—Sleigh & Wood, electrical and mechanical engineers, Consett Chambers, Newcastle-on-Tyne.—Messrs. L. Wood and H. Mearns have dissolved partnership. Mr. Wood will carry on the business alone.

John E. Favell & Co., electrical merchants, 2, North Street, Newcastle-on-Tyne.—Mr. J. E. Favell and Mr. T. D. Martin have dissolved partnership. Debts will be attended to by Mr. Favell, who will continue the business under the same style.

Dunster & Bacon, electricians, 19, North Holmes Road, Canterbury.—Messrs. C. G. Dunster and V. E. Bacon have dissolved partnership.

Trade Announcements.—Mr. Fred. Shaw, late technical manager and chief designer for Messrs. W. Robinson & Co., electric hoist manufacturers, of Birmingham, has now started in business at Guildhall Buildings, Navigation Street, Birmingham, as a consulting, mechanical, and electrical engineer, also as a manufacturers' agent, and is representing Messrs. Rowland Priest, of Cradley Heath, for electric and hand-power lifting appliances; Messrs. N. Horsfall & Co., of Manchester, for electric goods and passenger lifts; and the Springfield Electric Co., of Guiseley, for a.c. motors.

Hydro-Electric Power and Metallurgical Co.—A financial paper states that a meeting is to be held in Melbourne on April 21st for the purpose of considering a resolution that the name of the company be changed to Carbide and Electro Products, Ltd.

Messrs. Bass & Co., electrical engineers, 402, Essex Road, London, N.1, announce that the business has been sold by the proprietor, Mr. R. A. Jones, to Mr. H. H. Bayliss, who will trade under the existing name.

The Solidite Manufacturing Co., Ltd., of 28, John Street, Bedford Row, London, W.C.1, has been formed to take over the business of the Improved Solidite Co., Ltd., of Wandsworth. The new company has taken commodious works at Mitcham, where it will do business in any class of insulation material. All correspondence should be sent to the head office, as above, which is also the address of the company's sales managers, Messrs. Harwell, Ltd.

Catalogues and Lists.—The Whitworth Electric Lamp Co., Ltd., 195, North End Road, West Kensington, W.14.—April net trade price list of electric lamps and lighting accessories.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Pamphlets Nos. 316 and 317, giving illustrations, prices, and particulars of wireless telegraphy headgear receivers.

The I.T.C., Ltd., 8, Princes Street, Westminster, S.W.1.—Two illustrated pamphlets advertising the "New System" automatic intercommunication telephones.

The Rely-a-Bell Burglar and Fire Alarm Co., Ltd., 80, Coleman Street, E.C.2.—An illustrated folder advertising the firm's alarm system.

Messrs. Gillespie & Beales, Amberley House, Norfolk Street, London, W.C.2.—Folder announcing reduced prices for their "Nilfisk" electric suction cleaners, models A, B, C, and D.

Huntalite, Ltd., 25, Newman Street, W.1.—An illustrated and priced pamphlet advertising candle lamps and accessories.

The Rheostatic Co., Slough, Bucks.—An illustrated booklet describing unbreakable and non-corrodible resistance grids.

Private Arrangement.—Webster & Son, Rendezvous Street, Folkestone, electrical engineers, &c.—In response to a circular letter issued by Mr. W. J. Bennett, accountant, of 173, Fleet Street, London, E.C., a meeting of the creditors herein was held recently, at Anderton's Hotel, Fleet Street, E.C. The statement of affairs presented showed liabilities of £4,347, made up as follows:—Trade creditors, £3,491; bank overdraft, £475; and cash creditors, £381. After allowing £264 for preferential claims, the assets were estimated to realise £3,707, or a deficiency of £640. The assets consisted of good book debts £1,592; doubtful and bad debts £608, expected to produce £125; stock £2,031, valued at £1,500; work in progress £101; fixtures and fittings £343, estimated to realise £150; plant, machinery and tools £770, valued at £285; deposits £11 10s.; and cars £236, expected to produce £106. It was stated that the bank was unsecured except for two insurance policies, which had been deposited with it. The business was an old-established one, having been founded nearly 50 years ago. During the year ended March 31st, 1920, there was a net profit of about £300, while during the following 12 months there was a loss of £290. During the next six months there was a loss of about £200. Since that date the trade had improved, and during the period between October 21st, 1921, and February 20th last, there was a net profit of rather more than £260. The present position was largely due to the general slump in trade, and lack of capital. Several creditors expressed sympathy with the debtors, and one of the largest creditors said he had inspected the premises, which were well-equipped with good stock. Owing to pressing creditors a deed of assignment had been executed to Mr. W. J. Bennett, and after some discussion it was decided to confirm the deed, while a committee of five of the principal creditors was appointed to decide the course to be adopted for the carrying on of the business.

For Sale.—By direction of the High Court, Mr. H. Holmes, of Messrs. H. Holmes & Co. (in conjunction with Messrs. L. Farmer & Sons), will sell by auction on May 3rd at Winchester House, Old Broad Street, E.C., the freehold manufacturing premises, consisting of several blocks of buildings fitted with lifts, central heating, electric power, &c., at Grafton Road, Kentish Town, lately occupied by Messrs. John Brinsmead & Sons.

Peterborough Corporation Electricity Department invites offers for one 500-kW d.c. turbo-generator, one 240-kW Belliss-Crompton steam dynamo, six Lancashire boilers, two steam pumps, fan, valves, and piping. (See our advertisement pages to-day.)

Unemployment.—There was an increase of 2,753 in the total unemployed registered on April 3rd, the number being 1,742,517. The number of people working short time on April 3rd was 209,000, a decrease of 13,690 on the week. Relief schemes are reported to have absorbed, up to April 1st, 137,700 workers.

L.C.C. and Foreign Tenders for Stores.—The Highways Committee reports that in connection with the selection of names of firms to be placed on the lists, for certain classes of tramway stores, materials, &c., the question of the inclusion of the names of foreign firms arose. In view, however, of the fact that some time would necessarily elapse before the suitability of such firms to tender for the class of materials required could be ascertained, it was decided, so far as concerned contracts for which arrangements had to be made at an early date, to include only British firms, and it consulted the General Purposes Committee on the question of including in future selected lists the names of foreign firms. In conformity with the opinion expressed by the Committee, it has decided not to include the names of such firms on the lists. At the same time it desires to make it clear that in any case in which there are reasonable grounds for believing that tenders are not being submitted on an independent basis and that advantage is being taken of the limitation to British firms, it will not hesitate to invite tenders by advertisement, in which case foreign firms will be at liberty to tender equally with British firms.

The Handicapped Indian Electrical Industry.—*Indian Industries and Power*, in a recent editorial note, said that in view of the importance of electricity in the development of Indian industries, it would be thought that special encouragement would be given to the electrical industry. Such, however, is not the case, and the industry labours under a number of fiscal impositions. Invidious distinctions have been made between electrical and other apparatus. For instance, while shafting and belting are assessed according to the present tariff at 2½ per cent., electric cables and trolley wires, serving the same purpose—the transmission of power, are subjected to a rate of 11 per cent.; insulators and instruments are also rated at this level. In the case of electric lifts all but the motor and gearing are charged at 11 per cent., whereas, if the parts were ordered separately as iron or steel hardware, only 2½ per cent. would have to be paid. When relief is granted it is in a peculiar fashion. Formerly all switchgear was charged at 11 per cent., but, upon the receipt of protests, the Government decided to charge all starters and switchgear on *high-pressure* circuits at 2½ per cent. Thus the smaller users still retained the burden while large firms taking bulk supplies received relief. Another example of faulty rating is that while telephones are charged at 11 per cent., telegraph apparatus is rated at 2½ per cent. A movement is on foot to secure that all electrical apparatus shall be treated as power-driven machinery and charged at 2½ per cent.

The Building Exhibition.—The Building Trades Exhibition at Olympia, which closes on April 27th, is concerned chiefly with the design, erection, and decoration of houses, shops, &c., and the electrical industry does not figure very largely in the show. Two or three firms exhibit electric lifts. Medway's Safety Lift Co., Ltd., shows a working passenger lift, arranged for both automatic push-button operation and car switch control, fitted with tamper-proof locks and a decelerating device. This firm also shows a model lift with an electric door-operating device, as well as a service lift and a travelling pulley block. Messrs. Waygood-Otis, Ltd., also have a demonstration passenger lift in operation, the special feature of which is the overspeed braking device. On this stand are also examples of lift engines, controllers, and model lifts. Messrs. Marryat & Scott, Ltd., also show lifts and accessories, including an automatic gate-locking device, which is demonstrated; and a "trip indicator" recording the number of journeys and the duration of each. The Falkirk Iron Co., Ltd., shows a number of electric irons and the "Double-Ray" heater, which can be used for toasting or cooking small quantities of food. Numerous examples of its "New System" intercommunication telephones are displayed by the Telephone Manufacturing Co. (1920), Ltd., including "laryngaphones" and a loud-speaking telephone which enables a works manager to be spoken to from any part of the works and to reply without going near the instrument. Among the trucks, barrows, &c., exhibited by Mr. H. C. Slingsby is an electric truck, with elevating platform, of American design. Vacuum cleaning apparatus is shown by the British Vacuum Cleaner Co., Ltd., and the Sturtevant Engineering Co., Ltd. Several firms have examples of concrete mixers, and there are numerous electrically-driven machines for woodworking, rock crushing, and other purposes. A noticeable feature of the show is the popularity of the advertising globes containing coloured transparencies revolving round an electric lamp.

Certificates of Origin for Belgium.—The *Board of Trade Journal*, dated April 13th, contained a model certificate of origin such as is required by the Belgian Government in the case of many classes of goods imported into Belgium. It takes the form of a declaration that the articles were not made in Germany; the country of origin has to be given; and the certificate has to be attested by a Consular officer or a Chamber of Commerce.

Our Foreign Trade.—March Figures.—The following were the values of imports and exports of electrical goods and machinery during March, 1922:—

	March, 1922.	Inc. or dec.	3 months, 1922. Inc. or dec.
Imports.—	£	£	£
Electrical goods and apparatus	115,510	−109,899	−368,625
Machinery	774,345	−521,304	−2,177,861
Exports.—			
Electrical goods and apparatus	629,471	−526,247	−1,533,974
Machinery	5,882,023	−1,417,675	−5,439,515
Re-exports.—			
Electrical goods and apparatus	17,676	−12,648	−39,674
Machinery	82,999	−5,694	−69,955

Social Event.—On April 8th the members of the G.E.R. Electrical Department at Parkston Quay held their second annual electrically-cooked dinner at Harwich. Mr. J. H. Child occupied the chair and spoke of the progress which the department had made in a few years. Messrs. C. Orvis and Abbott were presented with wallets of Treasury notes upon their retirement, and an excellent musical programme was provided.

Chinese Notes.—The Chinese Merchants' Electric Co., in Nantao, Shanghai, consists of two departments, tramways and electric lighting. The business in both departments was prosperous last year. The company hopes to extend its tramway service on Chung Hwa Road. A newly imported electric plant is to be installed soon.

The Haiping Hydro-Electric Co., in Peitaiho, has been registered by the Ministry of Agriculture and Commerce.

Electrical Trade Openings in the Netherlands.—According to information forwarded by H.M. Consul-General, at Rotterdam, to the Department of Overseas Trade, the following undertakings may lead to openings for British trade:—

(Koog a/d Zaan) The Managing Board of the Starch Factory "De Beijenkorf," formerly M. K. Honig, of Koog aan de Zaan, intend adding to their works a new water-pump station with electric motors. Work will commence in a few months' time.

The Municipal Electric Works at Haarlem (address: Harmen Jansweg 131), intend extending the electric power station, estimate gld.248,000; work will be commenced as soon as possible.

A loan of gld.2,400,000 (divided into 2,400 7 per cent. bonds, of gld.1,000 each, is being raised by the Oost-Java Stoomtram Maatschappij for the purpose of completing the electrification of their lines at Soerabaja, Dutch East Indies. A double track will be laid down with a total length of about 21 kilometres.

The Trade Facilities Act and Electrical Schemes.—There was issued last week White Paper No. 62 (H.M. Stationery Office) containing a statement concerning guarantees which the Treasury has announced its willingness to give, under the Trade Facilities Act, 1921, for the payment of loans to be applied towards the carrying out of capital undertakings.

The total sum involved in loans is £14,958,145, £11,500,000 being for two electric railway schemes. Principal and interest are guaranteed, and the periods for repayment of the loans range from four to fifty years. The list includes the following:—

Calcutta Electric Supply Corporation, £500,000 (25 years; redeemable after 15 years). Purchase and installation of additional generating plant and buildings, additional high-pressure cables and transformers, and additional direct-current mains.

Underground Railways, £5,000,000 (50 years). Enlargement of tunnel of the City and South London Railway, improvement of stations and provision of new rolling stock; and the extension of London Electric Railway from Golder's Green to Edgware.

Minehead Electric Supply Co., £4,500 (25 years). Provision of generator and overhead mains.

South-Eastern and Chatham Railway Co., £6,500,000 (25 years). Electrification of suburban lines.

Kent Electric Power Co., £15,600 (20 years). Provision of mains, transforming apparatus and station plant.

German Glow Lamp Prices.—The Association of German Glow Lamp Works has increased the war-time addition on vacuum and gasfilled metal filament lamps from 400 to 550 per cent., and that on pocket lamps and telephone lamps from 500 to 650 per cent.

Book Notices.—U.S. Bureau of Standards. Technologic Paper No. 208, "Weighing by Substitution" (5 cents); and Scientific Paper No. 428, "The Radio Direction Finder and its Application to Navigation" (15 cents). Washington: Government Printing Office.—The second paper is a review of radio direction-finding methods and a long, illustrated description of the system developed by the Bureau of Standards is given. In the same connection, a copy of the "Radio Service Bulletin," issued monthly by the Bureau of Navigation, which has also been received, is of interest. This contains information relating to wireless navigation, including call signals, particulars of stations, and a great amount of technical information.

Messrs. Johnson & Phillips, Ltd., have sent us No. 8 of their "Transformer Abstracts," a series of booklets which should prove of great service to all who have to deal with transformers. This number is devoted to the influence of transformer connections on third harmonic voltages and currents—a subject dealt with in our columns some time ago (March 11th, 18th, and 25th, 1921). The previous "Abstracts" cover a wide field. The earlier issues contain information upon the construction of transformers; methods of making inquiries; and tendering. Then testing methods are explained, showing that "J. & P." transformers are carefully tested to ensure the fulfilment of the guaranteed performances. The tests upon ratio, impedance, insulation resistance, iron loss, &c., are included. Heat-run tests, which are made if required, receive separate treatment. Packing, examination, installation, and maintenance also receive attention. Other subjects covered by the series are the drying-out of transformers on site and switching-in current rushes.

Post Office Electrical Engineers' *Journal*.—Vol. XV, part I. April, 1922. London: The Electrical Review, Ltd. Price 2s. net.

"Metropolitan-Vickers Gazette," March.—Included in this issue are illustrated articles on "The Reconstruction of the Devastated French Winding Equipments," by Mr. J. F. Perry, A.M.I.E.E.; "Notes on Lightning and Lightning Arresters," by Mr. A. Bannister, B.Sc.; "Air-break Switches," &c.

The British Engineers' Association has issued a Special Economic number (March) of its *Bulletin*, discussing "Some Economic Realities and Reflections of Concern to British Engineers," and examining some of the salient features of the present industrial situation and their implications.

"Welfare Work," April, 1922. London: Welfare Workers' Institute.—The features of this number are articles on the present position of Trade Boards, and employés' service work from an American point of view; and reviews of foreign industrial developments, recent legislation, and the Society's activities.

Messrs. Cleworth, Wheal & Co., Ltd., Grange Engineering Works, Trows Lane, Castleton, near Manchester, have sent us a booklet containing a complete set of hygrometrical tables for wet and dry bulb temperatures, published with the permission of Prof. James Glaisher, F.R.S. The temperature of the dew point, the elastic force of vapour, the weight of vapour in a cubic foot of air, degree of humidity, and the weight of a cubic foot of air are given for temperatures between 30 and 100 deg. F.

Cable Manufacture in Holland.—The report for 1921 of the directors of the N.V. Nederlandsche Kabelfabriek states that the company was one of the many which suffered from the pressure of the times, partly as a consequence of the difference between the wages paid in Holland and those in Germany. Attention was directed in the report for 1920 to the increase in the percentage taken by the share of wages in the costs of production, and this had not decreased in the past year since the prices of raw materials had fallen to the pre-war level. German competition in Holland, which rendered it impossible in 1920 to obtain at least remunerative prices, had become accentuated in the meantime. The directors were confident that the moment was not far distant when this unsound condition must come to an end, either by an advance in the standard of living of the workmen in Germany or by a reduction of that in Holland. An influence in this direction could also be manifested by the fact that the enormous stocks which were placed on the German market after the termination of the state of war were being slowly consumed, and the Germans, with their depreciated currency, had to go and make purchases in the world's markets.

After these far from stimulating observations, the report proceeds to state that the working results in 1921 were not unsatisfactory. This situation for a considerable part was contributed to by the gradually extending sales in other countries, where the company in many cases only had to meet the competition of English firms. The development of the agencies in different countries was proceeding regularly, and it was expected that the export trade, which was first taken in hand in the autumn of 1920, would at one time absorb a large portion of the production. A second factor which affected the favourable results was the influence exercised by the rolling mill on the sale of rolled copper wire which was delivered to third parties. The new works' buildings were completed, and the lead press, one of the largest capacity, and the necessary machines were erected. The company continued to enjoy the confidence of customers, and if the latter purchased cables elsewhere it was solely due to the difference in the price. The gross profits amount to 1,106,000 florins, as compared with 1,588,000 florins in 1920. After writing off 422,000 florins for depreciation, as against 594,000 florins, and making other allocations, the net profits are returned at 625,000 florins, as contrasted with 951,000 in 1920. The directors recommend a dividend at the rate of 17 per cent., as against 23 per cent. in the previous year.

Belgian Cable Manufacturing Company.—The report of the Société Belge pour la Fabrication des Cables et Fils Electriques states that the net profits in 1921 amount to 750,000 fr., as compared with 1,248,000 fr. in the previous year. It is proposed to pay a dividend at the gross rate of 36.10 fr. per share, as against 45.62 fr. in 1920. The company shared in the increase in the capital of the Société des Cables et Tubes du Nord of Roubaix, which is the new title of the company formed in Paris in 1913 to sell the Belgian company's manufactures in France. But as it is no longer possible for this sale business to be transacted owing to the considerable increase in the French import duties, the Roubaix company is erecting a factory which will soon be brought into activity.

Brazilian Railway Tenders.—It is reported from Rio de Janeiro that the tenders sent in for the work of electrifying the Central Brazil Railway, the time for receiving which expired with March, emanated solely from British and American firms.

Applications for British Trade Marks.—Appended we give a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Those who desire to enter an opposition to any of the applications have one month in which to do so from the dates given below.

Little Giant. No. 41,242. Class 6.—Electrical tools, &c. Greenfield Tap and Die Co., Deerfield Street, Greenfield, Mass., U.S.A. (White, Langner, Stephens & Parry, 88-90, Chancery Lane, London, W.C.). April 12th, 1922.

Stomos. No. 422,413. Class 8.—Insulated electric cable. Fuller's United Electrical Works, Ltd., Grove Road, Chadwell Heath, Essex. April 12th, 1922.

Amporos. No. 422,595. Class 8.—Charged porous pots for primary batteries. The India Rubber, Gutta Percha and Telegraph Works, Ltd., 106, Cannon Street, London, E.C. April 12th, 1922.

Simplex. No. 422,898. Class 13.—Electrical apparatus and fittings of metal. Laurence Maxwell Waterhouse, trading as the L. M. Waterhouse Electric Co., 19, Rathbone Place, Oxford Street, London, W.C. April 12th, 1922.

Thermozote. No. 422,203. Class 50.—Electrical insulating substances of asbestos, mica, resin, oils, and bitumen. Charles Lancaster Marshall, "Dunoon," Doyle Gardens, Harlesden, N.W. April 12th, 1922.

LIGHTING AND POWER NOTES.

Australia.—Wagga (N.S.W.).—The scheme for supplying the district with electricity is nearing completion and the electricity for street lighting will be switched on on May 1st. The scheme, when completed, will have cost £75,000.

Victoria.—At a conference of western district municipalities, held at Camperdown, Sir John Marsh, chairman of the State Electricity Commission, explained the Commission's scheme for the supplying of electricity in bulk to the western district. The estimated cost of the scheme in its initial stages is £122,000, rising to £146,000 on completion.

Warringah (N.S.W.).—The Shire Council proposes raising a loan of £23,000 for the purpose of carrying out an electricity supply scheme. It is intended to purchase a bulk supply of electricity from the Sydney City Council.

Bradford.—Extensions.—As the result of a recent canvass of the residents at Wyke and district the Bradford Electricity Committee has recommended that the engineer be authorised to proceed with the laying of distributing cables, the provision of a transformer chamber, and other necessary works, the cost (approximately £5,415) to be defrayed out of borrowing powers recently authorised.

Bedworth.—Street Lighting.—The Parish Council has entered into a contract with the Leicestershire & Warwickshire Electric Light & Power Co., Ltd., for lighting the streets for a period of three years.

Bootle.—Sale of Undertaking Opposed.—A petition signed by a large number of consumers of electricity has been sent to the Electricity Commissioners and to the Town Clerks of Liverpool and Bootle opposing the proposed sale of the electricity undertaking to the Liverpool Corporation, the agreement to which has been signed and sealed by both Corporations, and awaits confirmation by the Electricity Commissioners. It is stated by the petitioners that the agreement (1) was come to by Bootle T.C. without consulting the burgesses of the borough and without due consideration; (2) contains no provisions at all to protect the petitioners' rights, and leaves the future prices to be charged for electricity to the absolute discretion of the Liverpool Corporation, and does not provide for a cheap and abundant supply; and (3) if it is advisable for the electricity undertakings to become a joint undertaking they should be worked jointly only on a partnership basis.

Blackburn.—Order Approved.—The Electricity (Extension) Special Order 1922, granting the Corporation power to supply electricity to the urban districts of Rishton and Great Harwood and the parishes of Wilpshire, Ramsgreaves, and Clayton-le-Dale, has now been approved by Parliament.

Budleigh Salterton.—Electricity Supply.—The U.D.C. is applying to the Electricity Commissioners for authority to generate and supply electricity for all public and private purposes within the urban district of Budleigh Salterton.

Canada.—Ontario.—In the Ontario Legislature on April 12th, it was decided to appoint a Royal Commission to conduct an investigation into the estimates and expenditure of the Hydro-Electric Power Commission. This has arisen through expenditure being greatly in excess of estimates.

Continental.—Finland.—The Finnish Water Power Committee has asked the Ministry for Communications to include in the Budget for 1923 an estimate of 22,000,000 marks for works in connection with the projected exploitation of the Imatra Falls and 250,000 marks for the purpose of investigations in connection with other waterfalls belonging to the State.

France.—A committee representing 71 communes in the Cantons of Rumigny, Signy-le-Petit, and Chaumont-Porcien, in the Ardennes, has recently been appointed to draw up a scheme for the establishment of a station to supply the district with electricity for lighting and power purposes.

Dundalk.—Loan.—The Urban Council has asked the Irish Minister of Economics to sanction a loan of £18,000 to extend the municipal electrical works.

Glasgow.—New Sub-stations.—The Dean of Guild Court has granted permission to the Corporation to erect electricity sub-stations at Alexandra Parade and Greenhead Street.

Area of Supply.—The Electricity Committee has recommended that application be made to the Electricity Commissioners for a Special Order for power to extend its area of supply to Killermont, Lambhill, Bishopbriggs, Rob Royston, Millerston, &c.

Guildford.—Report on Extensions.—Mr. G. W. Spencer Hawes has submitted to the Corporation a report on the extensions required at the electricity works. Owing to the increased load it has recently been necessary to run all the plant installed, including reserve machines, and Mr. Hawes therefore recommends the purchase of either (*a*) a 500-kW d.c. geared turbo-generator from the Peterborough Corporation; or (*b*) a Howden triple-expansion engine coupled to a 300-kW Crompton d.c. generator from the Harrow undertaking. A new 12,000 lb. per hour boiler is required, together with a superheater and mechanical stoker. Induced draught apparatus should also be installed. Mr. Hawes says that the present switchboard requires replacement. As regards cables, he suggests the installation of two new feeder mains, 370 yards of .2 sq. in., and 960 yards of .4 sq. in., and also 7,000 yards of three-core distributing mains. The consultant estimates the total cost at £20,000. The cost of purchase of the undertaking is £60,000, the borrowing of which has already received sanction.

Hemel Hempstead.—Electricity Supply.—The Town Council has accepted terms submitted by Watford Urban District Council for a supply of electricity. Watford is to apply for a Special Order, under which the Corporation will have the option of purchase after 21, 28 or 35 years, and afterwards at the end of each 10 years. The maximum charge to be inserted in the Order is to be 9d. per unit, but as to actual charges, consumers in the borough are to pay during the first 10 years 12½ per cent. above the prices at Watford, and during the next 11 years 5 per cent. above.

Holmfirth.—Extensions.—The Electricity Committee has decided to extend the mains from Wooldale Town End to Bill Lane to complete the circuit at Sycamore, and from Hey Gap to Cliffe.

London.—St. Marylebone.—The borough electrical engineer (Mr. C. H. Smyth) has sent us a list of revised charges for energy. The flat rate for lighting is reduced from 8d. to 7d. per unit; the maximum demand system is made more attractive by the reduction of the time for which the higher prices are charged; and the flat rate for heating and cooking is reduced from 1½d. to 1¼d. per unit, or a charge of 1¼d. per unit will include the hire of apparatus.

Lydney.—Proposed New Station.—An inquiry was recently held by the Electricity Commissioners into an application by the Norchard Syndicate, Ltd., for power to erect a generating station and to supply electricity to the Forest of Dean. The scheme was opposed by the Office of Works on the ground that the promoters should purchase the power station at Beachley instead of erecting a new station at Lydney. The engineer to the company stated that the estimated cost of purchasing the power station and of making the necessary alterations and extensions was £813,000. As against this he had firm contracts for building and equipping a new station, which could be fed with a water supply from the Lyd, with a coal supply which could be delivered into the station at a cost of a few pence per ton so far as freightage was concerned, from the adjacent railway, and, anticipating a low works cost, he estimated the selling price for power at a little over one penny per unit. Insistence on acquiring Beachley would end the scheme, as on the figures it would not be possible to raise the capital to finish it. Lord Bledisloe said that if any difficulty arose as to the site the promoters were welcome to select one anywhere on his estate.

Oswestry.—Maximum Charges.—The Electricity Commissioners have conducted an inquiry into the application of the Oswestry Electric Lighting & Power Co., Ltd., for sanction to increase its maximum charges from 8d. to 1s. 3d. per unit. Opposition to the proposal was offered by the Oswestry Corporation and the Oswestry Traders' Association.

Portrush.—Electricity Works Opened.—The electricity works erected by the Urban Council was opened on April 13th. About £17,000 has been expended on the scheme, and the majority of the business and private houses are connected.

Portsmouth.—Area of Supply.—The Town Council has decided to apply for a Special Order to extend the area of supply to the Havant Urban & Rural Districts, and the Warblington Rural District. The estimated cost is £15,800, and it is proposed that the charge to consumers in the new area shall be 2d. per unit above that at Portsmouth for lighting, and ½d. above for power.

Preston.—Purchase of Undertaking.—Negotiations were recently completed for the purchase by the Corporation of the electricity undertaking from the United Electric Supply Co.

Price Reductions.—Reductions are to be made in the charges for electricity in the following districts: Bridgend, Denny (Stirlingshire), Halifax, Hove, Nuneaton, Ripley, St. Helens, Wigan, and Worcester.

Sheffield.—Proposed Closing of Station.—At a recent meeting of the District Council No. 2, Electricity Supply Industry (Yorkshire, &c.), it was reported that the Sheffield Corporation had the closing-down of the Kelham Island power station under consideration, and that the District Council had received a request to intervene on behalf of the men who would necessarily be discharged if this took place. The Council decided to await the result of a Corporation meeting upon the subject before taking any action.

Shrewsbury.—Loan.—The Town Council has decided to make application for sanction to borrow £15,000 for the erection of oil engines to supplement the steam engines now in use at the electricity works.

South Africa.—Barberton.—The municipal authorities are borrowing £17,000 for the institution of an electricity undertaking.

Stafford.—Loan Sanctioned.—The Town Council has received the sanction of the Electricity Commissioners to the borrowing of £4,710 for cable and switchgear.

Torquay.—Parliamentary Bill.—At a recent meeting of ratepayers approval was given to the Bill being promoted by the Town Council for the purchase of the Newton Abbot undertaking of the Urban Electric Supply Co., Ltd.

Truro.—Electricity Supply.—At a meeting of the City Council the Town Clerk read the reply of the Electricity Commissioners expressing the opinion that it would be much better for the Corporation to purchase a bulk supply from the power company than to establish a new generating station at Truro. He was in communication with the power company as to its submitting the draft of an agreement in accordance with Section 19 of the Electricity (Supply) Act, 1919, with reference to the cost of laying the h.p. main outside the area covered by the Order of 1913.

United States.—California.—The Federal Power Commission has approved the issue of a final licence to the San Joaquin Light & Power Corporation, of Fresno, California, for the construction of a hydraulic power plant on the north and west forks of the Kings River, in California. According to the plans submitted the project will cost approximately 50 million dollars.—*Reuter's Trade Service* (Washington).

Warrington.—Proposed Extension of Supply.—The Corporation has referred to the Electrical Engineer a suggestion by the Great Sankey Parish Council that the district be circularised with reference to the supply of electricity.

Wigan.—British *v.* Foreign Plant.—At a recent meeting of the Town Council, the chairman of the Electricity Committee said that tenders had been invited for the supply and erection of a new turbo-alternator and condensing plant. Twenty-one tenders were received, the majority being British, and the Committee had decided not to consider the foreign offers. Although the difference between foreign and British prices appeared to be considerable, upon consideration it was found that the benefits to be obtained by the purchase of British plant gave British manufacturers the right of priority. Apart from this, reductions in wages would result in a lowering of prices; a clause to this effect appeared in all contracts.

TRAMWAY AND RAILWAY NOTES.

Australia.—Melbourne.—The North Melbourne Electric Tramways & Lighting Co. has received an offer from the State Electricity Commission of Victoria for the acquisition of its undertakings. The Commission has offered £110,000, and to take certain stores at a valuation not to exceed £3,000.

Ceylon.—Railway Electrification.—According to *Indian Industries and Power*, the electrification of a portion of the G.I.P. Railway system has been the subject of several reports by Messrs. Merz & McLellan, consulting engineers, engaged to advise on the scheme. The proposals drawn up provide practically for doubling the present suburban service. The annual train mileage on the suburban side, which now amounts on an average to 900,000, will, when the full service is introduced, enable more than twice that figure to be satisfactorily worked. It is pointed out that the first necessity is for an accelerated service as far as Thana, including the Harbour branch and the Mahim Chord line, to give direct access to the new trade centres to the east of the island. On completion an extension to Kalyan would be undertaken.

Doncaster.—New Track.—The Corporation is applying to the Ministry of Transport for sanction to borrow £2,150 for the doubling of the existing single tramway track from the loop in Arksey Lane to a bend in the High Street.

Order Approved.—The Ministry of Transport has sanctioned the Light Railways (Extensions) Order, 1922, authorising the extension of the existing light railway undertaking of the Corporation.

Hutton Magna.—Extension of Time.—The Minister of Transport has extended the time of the Hutton Magna Light Railway Order, 1915, for the completion of the railway, &c., until May, 1923.

India.—Calcutta.—The Corporation has decided to serve a notice on the Calcutta Tramways Co., requesting it to carry out the repair of tramway tracks within a reasonable period. In the event of default proceedings are to be instituted against the company.

London.—Withdrawal of L.C.C. Proposal.—Owing to the passing of a proviso in the House of Commons, rendering the L.C.C. scheme for the construction of a railless trolley route from Norwood to Lee Green liable to veto by local authorities, the Council decided to withdraw that part of its Bill. Mr. Neal (Parliamentary Secretary to the Ministry of Transport) said that this instance demonstrated the extreme inconvenience which arose from having separate authorities responsible for traffic and roads.

Western Valleys (Mon.).—Extension of Time.—The Minister of Transport has extended the times of the Western Valleys (Mon.) Railless Electric Traction Act, 1913, and of the Western Valleys (Mon.) Railless Electric Traction (Extension) Order, 1914, for the completion of the trolley vehicle equipment, until February, 1923, and July, 1923, respectively.

TELEGRAPH AND TELEPHONE NOTES.

Finland.—Esthonia Cable.—The President of the Republic of Finland has just confirmed a proposal to be placed before the Parliament concerning a cable agreement between Estland and Finland.

Switzerland.—High-speed Wireless Service.—A new high-speed wireless service, available to the public, between Berne and Great Britain, was inaugurated on April 12th. The new Swiss wireless station has been erected by the Marconi Co. for a Swiss company, in which the Swiss Government is interested, and will ultimately place Switzerland in direct touch with every European country.—*Reuter's Trade Service.*

The Telephone Service.—A resolution was passed on April 11th by the London Telephone Advisory Committee urging that prompt effect should be given to the report of the Select Committee on the Telephone Service as a whole, and especially to those portions relative to the reduction in charges, the separation of the administration of telephones and telegraphs from mails, the division of the country into separately administered districts, and the securing of better co-ordination throughout the Department.—*Morning Post.*

New Birkenhead Exchange.—A new telephone exchange was opened in the Liverpool district last week, and will be known as Willaston (Birkenhead). The exchange will serve a portion of the existing Bromborough Hooton and Neston exchange areas.

Wireless Telephony.—International Conference.—The International Wireless Conference, which met at Cannes, has been transferred to Paris, says the *Daily Express*. The delegates are discussing wireless telephony and the construction of wireless stations in Brazil and the Argentine.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Argentina.—Buenos Aires.—June 28th. Municipal Council. Plant for hydro-electric generating station and transformer sub-station.*

May 10th. 37,000 metres of 6,600-V cable and 10,000 miles 2,200-V cable.

Australia.—Melbourne.—May 11th. Victorian Electricity Commissioners. 960 miles of aluminium steel-cored cable; 3,000 lb. flat armoured wire; 4,000 lb. No. 4 tie wire.

September 1st. Victorian Electricity Commissioners. Five surface feed-water heaters, six surface vapour condensers, and 12 feed-water evaporators.—*Reuter's Trade Service* (Melbourne).

July 5th. Victorian Railways. One 2-ton storage battery truck with jib crane and lifting magnet. Three passenger electric elevators and one freight elevator with all equipment. —*Reuter's Trade Service* (Melbourne).

Belgium.—May 9th. The municipal authorities of Saint-Gilles, Brussels. Two sets of asynchronous motors and continuous-current generators, together with the necessary accessories. Service d'Electricité, 40, Rue de Bethleem, Saint Gilles.

May 8th. Direction des Ponts et Chaussées, 52, Boulevard du Régent, Brussels. Installation of an electric lift at the Palais de Justice, Brussels. Cahir des Charges No. 11, 15, Rue des Augustins, Brussels.

Brighton.—May 8th. Electricity Department. One 6,000-kW turbo-alternator and exciter with condenser, and one geared turbo-driven d.c. generating plant. (April 7th.)

Cardiff.—May 2nd. Overhead steel bunkers and constructional steelwork. The electrical engineer, The Hayes, Cardiff.

Doncaster.—May 8th. Electricity Department. Two water-tube boilers, with economisers, induced draught plant, and steel chimney. (See this issue.)

Edinburgh.—April 24th. Tramways Department. 70 trucks and electrical equipment of cars, also wheels and axles. Tramway manager, 2, St. James' Square, Edinburgh.

Egypt.—Alexandria.—June 1st. Ports and Lights Administration, The Arsenal. Six months' supply of general stores, including electrical gear, &c.—*Reuter's Trade Service* (Cairo).

Glasgow.—May 1st. Electricity Department. Cables, meters, and carbons, for 12 months. (April 14th.)

London.—H.M. Office of Works.—May 4th. Engineering labour (electrical, &c.) required in the Newcastle-on-Tyne and Southampton districts during a period of three years. Secretary, H.M. Office of Works (Contracts Branch), King Charles Street, London, S.W.1.

Metropolitan Asylums Board.—April 26th. Installation of two electric automatic passenger lifts and two electric automatic service lifts at Tooting Bec Mental Hospital, &c. (April 7th.)

New Zealand.—Auckland.—June 1st. Tramways Department. Electric equipment for ten bogie tramcars.—*Reuter's Trade Service* (Melbourne).

Wellington.—July 8th. Public Works Department. Eight steel transmission line towers.

Salford.—April 22nd. Electricity Department. Two forced-draught mechanical stokers for two Lancashire boilers. Borough electrical engineer, Electricity Works, Frederick Road, Salford.

Siam.—Bangkok.—June 5th. Department of Posts and Telegraphs. Telegraph and telephone materials, about £10,000. Chief electrical engineer, Telephone Exchange, Bangkok.*

York.—May 5th. Electricity Department. One 500-kW rotary converter, transformer switchgear, &c. (See this issue.)

*A copy of the plan, specifications, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—The contract for cables and accessories for the Brussels Corporation (see list of tenders, Electrical Review, April 14th, p. 523) was secured by the A.C.E.C., Charleroi, of London, at a price of over £40,000.

Buxton.—Town Council. Accepted:—
Cable.—Callender's Cable and Construction Co., Ltd.

Cannock.—Urban Council. Accepted:—
Wiring the Council offices.—Raybould & Ancott.

Glasgow.—Tramways Department. Recommended:—
Copper trolley wire.—Thomas Bolton & Sons, Ltd.; British Insulated and Helsby Cables, Ltd.
Corporation. Accepted:—
Alterations to the electric light installation at Townhead District Library. —Johnston, Park & Co.

India.—Calcutta.—Contracts in connection with the scheme of the Calcutta Electric Supply Corporation, Ltd., for extensions to the main power station, amounting to about £250,000, have already been placed. According to *Indian Engineering*, an order for a 15,000-kW turbo-alternator generating set has been given to the English Electric Co., Ltd. Among other firms to secure orders, states the *Industrial Daily News*, are the Stirling Boiler Co., Ltd., for two 60,000-lb. boilers; the British Thomson-Houston Co., Ltd., for transformers; Hick, Hargreaves & Co., Ltd., for condensing plant; and Henley's Telegraph Works Co., Ltd., for cables.

London.—Metropolitan Asylums Board. Accepted:—
Installation of six electrically-driven sewing machines at the Eastern Hospital (£116).—Jones' Sewing Machine Co.
St. George's Home, alterations, &c., to electric lighting, fire alarms, and domestic bell installations (£85).—S. Reed & Son.

Correction.—The list of tenders for supply of cable for 12 months, also for constructional steel work, given on page 528 of our last issue, related to Stepney, and was inserted beneath the Marylebone sub-heading through an error on the part of the printer.

Portsmouth.—Town Council. Accepted:—
Green economiser for the electricity works (£3,726).—Babcock & Wilcox, Ltd.

Sunderland.—Electricity Department. Accepted:—
600 yards .15 four-core cable.—British Ins. & Helsby Cables, Ltd.
Service boxes and link boxes.—Callender's Cable and Const. Co., Ltd.
Creosoted redwood capping.—Armstrong, Addison & Co.
L.p. switch panels.—Ferguson, Pailin, Ltd.
Temperature and flue gas recorders.—Cambridge & Paul Scientific Instrument Co., Ltd.
Electric drilling machine.—Consolidated Pneumatic Tool Co., Ltd.

FORTHCOMING EVENTS.

Salford Technical and Engineering Association.—Saturday, April 22nd. At 2.45 p.m. Visit to Manchester Corporation electric power station, Barton.

Electrical Trades Benevolent Institution.—Monday, April 24th. At the Institution of Electrical Engineers, Victoria Embankment, S.W. At 2.30 p.m. Annual general meeting.

Institution of Civil Engineers.—Tuesday, April 25th. At the Institution, Great George Street, S.W. At 6 p.m. Annual general meeting.

Royal Society of Arts.—Wednesday, April 26th. At John Street, Adelphi, W.C. At 8 p.m. Paper on "The Use and Advantages of Electric Power in the Factory, as Illustrated by its Application to the Jute Industry," by Mr. J. F. Crowley.

Optical Society.—Thursday, April 27th. At the Imperial College of Science, South Kensington, S.W. At 7.30 p.m. Lecture on "The Mechanical Construction of the Microscope from a Historical Standpoint," by Prof. A. Pollard.

Institution of Electrical Engineers.—Thursday, April 27th. At the Institution, Victoria Embankment. At 6 p.m. Paper on "Protective Apparatus for Turbo-alternators," by Mr. J. A. Kuyser.

(Liverpool Sub-Centre).—Monday, April 24th. At the University, Liverpool. At 7 p.m. Lecture on "Engineering Advertising and the Work of the E.D.A.," by Mr. J. W. Beauchamp.

(East-Midland Sub-Centre).—Tuesday, April 25th. At the College, Loughborough. At 6.45 p.m. Paper on "Electric Vehicles," by Mr. R. J. Mitchell.

(South-Midland Centre).—Students' Section.—Tuesday, April 25th. At the University, Birmingham. At 7.30 p.m. Annual general meeting.

(North-Western Centre).—Tuesday, April 25th. At the Engineers' Club, Manchester. At 7 p.m. Annual general meeting. Lecture on "Engineering Advertising and the Work of the E.D.A.," by Mr. J. W. Beauchamp.

Friday, April 28th. At the Manchester Municipal College of Technology, Sackville Street. At 7.30 p.m. Lecture on "Recent Developments in Atomic Research," by Prof. W. L. Bragg, F.R.S.

(North-Midland Centre).—Tuesday, April 25th. At the Hotel Metropole, King Street, Leeds. At 7 p.m. Annual general meeting and smoking concert.

(Scottish Centre).—Friday, April 28th. At the Technical Institute, Dundee. At 7.30 p.m. Paper on "Single and Three-phase Commutator Motors with Shunt and Series Characteristics," by Dr. S. P. Smith.

Liverpool Engineering Society.—Wednesday, April 26th. At the Royal Institution, Colquitt Street. At 8 p.m. Annual general meeting.

Illuminating Engineering Society.—Thursday, April 27th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Joint discussion with the Royal Society of Medicine (Sections of Surgery and Ophthalmology) on the "Use of Light in Hospitals."

Junior Institution of Engineers.—Friday, April 28th. At Caxton Hall, S.W. At 8 p.m. Lecturette, "Some Notes on the Utilisation of Water Power," by Capt. H. Whittaker, late R.E.

Institution of Mechanical Engineers.—Friday, April 28th. At the Institution, Storey's Gate. At 6 p.m. Paper on "An Account of Some Experiments on the Action of Cutting Tools," by Prof. E. G. Coker and Mr. K. C. Chakko.

(Graduates' Section).—Monday, April 24th. At 7 p.m. Paper on "Jigs and Tools," by Mr. B. A. C. Hills.

Electrical Power Engineers' Association.—Southern Division.—Friday, April 28th. At the Institution of Electrical Engineers. At 7 p.m. Lecture, "Some Notes on the Design of Generating Plant," by Mr. C. F. Hewitt.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of suppliers or manufacturers of :—

The "Watchman" safe or cash box (containing electrically operated alarm).

Electric poker (a device for igniting coal fires without the aid of wood or paper).

NOTES.

The Lock-out.—There is little to report respecting the engineering trade lock-out beyond the fact that negotiations between the Engineering Employers' Federation and the 51 trade unions broke down at the end of last week. The lock-out of members of the A.E.U. is now in its sixth week, and as we go to press there is a reported likelihood of the 51 unions returning to associated action with the A.E.U., from which they broke away in order to negotiate separately. The A.E.U. Executive is inviting loans of £1 and upwards for fighting purposes, with the intention of repaying the money immediately after the lock-out ends. It is stated that the unions were to meet again on Wednesday; also that the employers' federations were to meet to receive the report of the Negotiating Committee and to decide when the suspended lock-out notices should be enforced. There is a renewed de-

mand from the labour side for a special meeting of the Trades Union Congress to consider the question of joint action, and there is, among many other rumours, one to the effect that the continuation of the struggle may occasion secessions from the employers' side—with what truth this report may be credited we know not.

The breach with the 51 unions is over definitions of managerial functions and workshop control.

Wiring by Non-Unionists.—A case, similar to that which occurred at Hackney a short time ago, has arisen at Chelmsford, where members of the E.T.U. employed by the Electric Supply Corporation have been forbidden to connect up an installation erected by men who were not members of the E.T.U. As a consequence of the inability, or unwillingness, of the Trade Union members of the District Whitley Council for the area to remove the veto the employer members have withdrawn from that body, and the case is to be referred to the National Council.

An Echo of the Johannesburg Strike.—Mr. Bernard Sankey, general manager of the municipal Gas and Electric Supply Department, has sent us a copy of the Johannesburg *Star*, dated March 18th. Among numerous advertisements reflecting various phases of the recent industrial trouble there appear three calling for men to carry on the public services. All trades are asked for and employés on strike are apparently permitted to return.

The news columns are almost wholly devoted to information about the strike and its consequences. One of the most serious of these items is a long list of killed and wounded which makes the reader realise what happened on the Rand far better than the bare statement of the number of casualties which appeared in the English Press.

An article appears under the heading "Epic of the Power Station"; the following is abstracted from it:—

"There is a log book at the Johannesburg power station, and it holds three recent entries of an interesting character. They constitute a brief but graphic record of the strike. The first was written across the page in ink, on Monday night, February 27th, and reads, 'Station shut down by the command of the shop stewards.' But a similar entry on the Wednesday following says: 'Station put in commission, not by command (these three words are heavily underlined) of the shop stewards.

"On Sunday, March 12th, there is no entry of this nature in ink; only the page torn at the top; a tear that continues for many leaves. That record was made by a bullet, a sniper's message in all probability, which performed a wonderful ricochet stunt, but did nothing further beyond provide a topic of amused conversation on the part of the men who were carrying on.

"On Thursday the huge machinery hall was bright and clean, but its full thunder and reverberation did not smite the ear. The public has little idea of the task that confronted the officials and the volunteers when the fires were drawn on that memorable Monday night. To the credit of the men who came out, let it be said that they left everything in as good order as their peremptory exit allowed, and that they did not make the slightest attempt to injure plant or make the running of it more difficult for their successors. But the 'clean' coal which had been used for some weeks was a very dirty coal as far as its burning properties were concerned, and it had left the furnaces in anything but a clean state. These had to be got into condition first of all, and this and a score of other matters had to be undertaken in candle light, and by men who were totally unacquainted with the plant and place where they were working. To make matters worse, the frightened natives could not be discovered, having hidden themselves in every possible dark corner."

In the end, by dint of hard labour, the volunteers won through and maintained the supply.

The Electrification of Russia: Proposed Government Industrial Bank.—The Chief Committee for Electrification, in considering the means for giving effect to the decree on the electrification of Russia, has come to the conclusion that the work of electrification can only assume its due importance if it is done at once on a wide scale. The Government means for this purpose are insufficient; therefore it is necessary to invite private capital, both Russian and foreign, for the purpose. In view of this the Chief Committee for Electrification has drawn up a project for a Government Bank of Industry for the Electrification of Russia with a corresponding participation of the limited capital of the co-operative societies, and with the addition of foreign capital. This project was examined some time ago by the Government Planning Committee, says a leading Russian journal. According to the project of an industrial electrical share bank, the shares would be issued in series of a million at 10 roubles gold each, up to a total of 60,000,000 roubles gold. The preferential right of taking shares and bonds would be reserved to the Government. For the purpose of an extensive introduction of private capital in the Government Industrial Bank for the Electrification of Russia, the Government proposes guaranteeing an income on the shares and bonds for a period of fifteen years at the rate of 8 per cent. gold; and all accounts with shareholders would be kept in money values at the official rate of the day. Thus the interests of clients of the bank are protected against a decline in Government securities. Besides this, the bank would have the prerogative of extensive business operations. For the organisation expenses in connection with the bank the Government is asked for 10,000,000 roubles gold. The Bank would begin business after the amortisation by the Government of 51 per cent. of the shares and bonds of the first issue. In submitting this proposition to the Government Planning Committee, the representatives of the Chief Committee for the Electrification of Russia quoted the experience of Japan, where such a bank was formed for financing the industrial exploitation of Sagalien and Corea. The Japanese guaranteed a 5 per cent. interest on the shares, and in the event not only had not the Government to pay, but the Bank paid dividends of 6 to 8 per cent. on the shares. The electrification of Russia is of such primary importance that credits should be opened for the purpose, and the easiest conditions should be offered. In the discussion that followed the presentation of the report, Prof. Gorieff said that considering the guarantee of an 8 per cent. dividend provided in the statutes was quite sufficient to attract capital from the Entente countries, German capitalists would willingly take part in the Bank, as Germany was mostly a provider of material for the needs of electrification. In conclusion, the Government Planning Committee decided that for a way out from the economic decline of the country the plan submitted for financing the electrification most certainly merited adoption; and the Committee urged the earliest possible formation of a board for the Bank, that could proceed at once to preparatory measures.

A 20,000-kW Electric Boiler.—For nearly six months the Belgo-Canadian Pulp & Paper Co. has been producing its process steam with a 20,000-kW electric steam generator. Sixty thousand pounds of water are being evaporated per hour with a thermal efficiency of 98 per cent., including losses in 100 ft. of piping. According to reports, engineers of the paper company have estimated a saving of $4,000 per month with the new system, which saves 75 tons of coal a day. Installation costs—about $25,000—were 40 per cent. less than the cost of the coal-burning plant replaced.

Three-phase, 6,600-volt power from the Shawinigan Water and Power Co., Montreal, is utilised directly in the tanks, the resistance of the water converting the electrical energy into heat for generating the steam. The amount of steam generated, the pressure, and the amount of water used are governed by the depth of immersion of the electrodes in the tanks. The design was developed by F. T. Kaelin, chief engineer of the power company.

Already generators of this type, with a total rating of 100,000 kW, have been installed or contracted for, according to F. Hodson, president of the Electric Furnace Construction Co., Philadelphia. He declares that the most important applications of the electric steam generators will probably be in industries situated within convenient transmission range of hydro-electric plants. Where savings in initial cost, space occupied and operating expense are very important, the electric steam generator will have many points in its favour.—*Electrical World*.

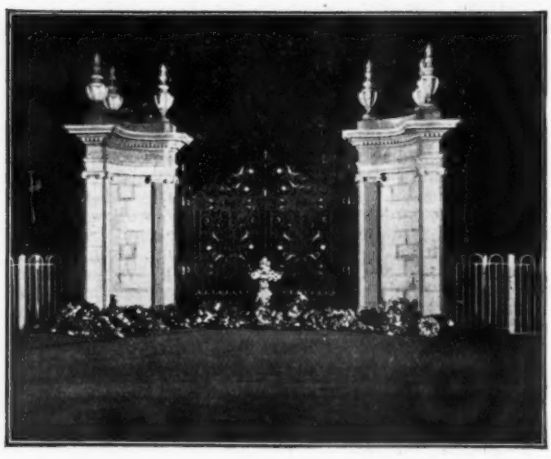
Another Woman Engineer.—A woman engineer has set up a business for herself in Exeter, and has already installed one lighting set for a country house. She is Miss Partridge, B.Sc., a member of the Institution of Electrical Engineers, and also an active member of the Women's Engineering Society. She is holding a small exhibition of electrical appliances next month. During the war Miss Partridge was working as head of a testing department in an electrical firm, and immediately afterwards was responsible for the production of material in another large concern.—*Evening News*.

Electricity in Agriculture.—In the Spalding district of Lincolnshire—the centre of a flower-growing industry—growers are now using electric light in order to secure early bloom. Large glasshouses are being fitted up with powerful electric lamps, and during a part of the night and on sunless and dull days the light is switched on and the bloom is thus secured much earlier than would otherwise be the case. In this way in one glasshouse 150,000 valuable tulips were brought to perfection, and in another 500,000 ornatus.—*Westminster Gazette*.

Fatality.—An inquest was held at Wakefield on April 18th into the death of W. Ogilvie, an employé of the Yorkshire Electric Power Co., Ltd. A witness stated that he was requested to attend to a failure of supply on April 17th, and upon entering the Rothwell sub-station he found deceased lying on the floor. Both his hands were severely burned, showing that he had grasped a live conductor. To reach the latter it was necessary to raise the hands above the head. Evidence was given showing that the deceased suffered from depression and insomnia, and a verdict of "Suicide while temporarily of unsound mind" was returned.

Termites in California.—The ravages of insects abroad have recently been described as constituting a peril to civilisation. In a letter to the *Electrical World*, Mr. R. E. Cunningham, Superintendent of Distribution to the Southern California Edison Co., states that termites have begun to attack untreated cedar poles, their operations extending to the crossarms and even the insulator pins. The damage can be prevented by creosoting the poles.

Floodlighting a War Memorial.—The British-Thomson-Houston Co., Ltd., has sent us the accompanying photograph and particulars of an effective use of floodlighting. The subjects on this occasion were the memorial gates at Rugby, recently unveiled by Lord French. Two B.T.H. floodlight projectors were employed; these were fitted with "Mazda"



Floodlighting of the War Memorial Gates, Rugby.

gasfilled lamps and fixed on the opposite side of the road at a height of about 7 ft. To avoid any unevenness of light diffusing mirror reflectors were used, and each projector was fitted with a "spill shield," ensuring that the light was kept within the correct limits. The excellence of the result can be fairly well gauged from the illustration.

INSTITUTION NOTES.

Institution of Electrical Engineers. — North-Eastern Centre.—The annual general meeting of the Centre was held on April 10th, Dr. W. M. Thornton in the chair. The President of the Institution (Mr. J. S. Highfield) was present, and received a cordial welcome. The report of the committee stated that the membership of the Centre continued to grow, the principal increase, as in the previous year, being in the students' section. The membership was: members, 57; associate members, 209; associates, 10; graduates, 51; and students, 161; making a total of 488, compared with 449 in the last session. The average attendance at the meetings had been 70.

Mr. W. T. MacCall, the treasurer, submitted the financial statement, which showed an increased credit balance in hand.

The officers for the session 1922-23 are as follows: Chairman, Mr. E. Fawssett, M.I.E.E.; Vice-Chairmen, Messrs. T. Carter, M.I.E.E., and F. G. C. Baldwin, M.I.E.E.; Honorary Secretary, Mr. H. B. Poynder, A.M.I.E.E.

East Midland Sub-Centre.—The meeting at which Mr. R. J. Mitchell was to have read his paper on "Electric Vehicles" has been postponed from April 18th to the 25th, when it will be delivered at Loughborough College at 6.45 p.m.

South Midland Centre.—At a meeting held on April 5th Dr. C. C. Garrard and Mr. F. Gill exhibited their kinematograph films. At the conclusion Mr. R. A. Chattock, in thanking Dr. Garrard and Mr. Gill for the exhibition they had given, asked Dr. Garrard whether any photographs had been taken of the operation of high-voltage switches under heavy currents when they were operating under the normal high voltages for which the switches were designed. Whilst the demonstration given of the breaking of these switches under heavy currents at low voltages was quite instructive, the much more onerous conditions of breaking under high voltage would probably produce quite different results in the operation of the switches.

Sheffield Students' Section.—Members of the section paid a visit of inspection to the new Rotherham station on April 8th. Mr. E. Cross (the chief engineer), and Mr. H. W. Rodgers (station superintendent), acted as guides, and afterwards, at the Technical Institute, Mr. Rodgers gave a description of the undertaking, while Mr. Cross imparted particulars of working costs and capital expenditure.

Scottish Centre.—At a meeting of the Scottish Centre of the Institution, held in Glasgow last week—Mr. E. T. Goslin presiding—the following office bearers were elected:—Chairman: Mr. A. S. Hampton; vice-chairmen: Messrs. R. B. Mitchell and Alex. Lindsay; hon. secretary: Mr. Joseph Taylor; assistant hon. secretary: Mr. W. F. Mitchell; chairman of Students' Section: Mr. J. F. Nielson.

Société des Ingénieurs Civils de France.—In his presidential address to the British Section, on April 11th, Mr. W. Noble Twelvetrees advocated closer relationships between French and British engineers, and to that end suggested that the relative value of engineering diplomas in the two countries should be determined to facilitate the entry of members of one nation into the engineering institutions of the other.

Birmingham and District Electric Club.—The final meeting of the session was held on April 8th, when a paper was read by Mr. V. H. Pearson on "Marine Salvage." During the late war Mr. Pearson personally assisted at the salving of over twenty ships, so that his reminiscences and experiences were interesting and at times thrilling. The lecturer explained at length the various methods used, and illustrated his remarks by a large number of lantern slides illustrating various stages of many of the ships being salved.

Stoke-on-Trent Association of Engineers.—The annual meeting of the Association was held on April 1st, Mr. W. H. Good (President) presiding. Dr. A. W. Ashton, M.I.E.E. (Principal of the Engineering Department, Central School of Science and Technology, Stoke), was elected President for the 1922-23 session. The accounts showed a credit balance of £15. The meeting was followed by the reading of a paper on "Heat Losses in Exhaust Steam," by Mr. A. E. Edwards, who reviewed a number of methods for the employment of the heat in waste steam.

Diesel Engine Users' Association.—At the last meeting of the Association Mr. Harold Moore read a paper on "Some Characteristics of Petroleum Oils used on Diesel Engines." He referred to the various tests carried out on fuel oils, and explained the bearings of these tests on the behaviour of oils in the engines. In this manner specific gravity, flash point, viscosity, cold test, heat value, ultimate composition, sulphur content, spontaneous ignition temperature, ash content, mechanical impurities, water content and Engler distillation, were dealt with.

Institution of Civil Engineers.—The Council has made the following awards for papers read and discussed during the session 1921-22: Telford medals to Sir Henry Fowler, K.B.E., Mr. H. N. Gresley, C.B.E., and Mr. H. F. Parshall, D.Sc.; a Watt medal to Mr. William Willox, M.A.; an Indian premium to Mr. F. G. Royal-Dawson; and Telford premiums to Mr. A. W. Rendell, Mr. W. F. Stanton, B.Sc., and Mr. A. C. Walsh. The Council has also made the following awards for papers printed without discussion in the *Proceedings* for the session 1920-21; A George Stephenson medal to Mr. J. H. Taylor; Telford premiums to Mr. F. H. Hummel, M.Sc.; Mr. E. J. Finnan, M.Sc., and Mr. Herbert Chatley, D.Sc.; and a Trevithick premium to Mr. G. E. Lillie, F.C.H.

Institute of Physics.—The Institute of Physics, of which Sir J. J. Thomson, O.M., is now President, is arranging for the delivery of a course of public lectures with a view to indicating the growing importance and place which physics now holds in industry and manufacture. The first of these lectures will be delivered by Prof. A. Barr, of Glasgow, on April 26th, at 8 p.m., at the Institution of Civil Engineers. The Rt. Hon. H. A. L. Fisher, Minister for Education, has accepted the invitation of the Institute to preside on this occasion.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

The Earl of Crawford and Balcarres has been appointed Minister of Transport in succession to Viscount Peel. Lord Crawford will receive no salary for his new post; he will continue his duties as First Commissioner of Works, and has been invited to become a member of the Cabinet.

There were 38 applications for the position of general manager of the Manchester Corporation tramways, rendered vacant by the retirement of Mr. J. M. McElroy. The Special Sub-committee selected five, and, later, decided to ask three candidates to appear before it on April 25th. The three are Mr. E. S. Rayner (general manager of the Hull Corporation tramways), Mr. J. S. D. Moffet (general manager of the Belfast Corporation tramways), and Mr. H. Mattinson (chief civil engineer of the Manchester Corporation tramways).

Swindon Town Council has referred back to the Finance Committee for reconsideration a recommendation to reduce the salary of the electrical engineer, Mr. A. Nicklin, from £500 to £475 a year, and that of Mr. T. Metcalf, manager and secretary of the tramways, from £520 to £494.

Mr. Charles Collinge, permanent way superintendent of the Coventry Corporation Tramways, who is leaving for Rochdale, has been presented by the staff with a suit case.

We are informed the following changes have recently been effected at the Simplex and Credenda Joint Sales Depots, at

both Cardiff and Newcastle, mainly as the result of Mr. A. G. Robson's resignation from the management of the latter office. The appointment of Mr. J. Entwistle as manager of the Newcastle and District branch, made vacant the position he has hitherto occupied in charge of the Cardiff office. He has been succeeded there by Mr. H. E. Barringer, who has been connected with the depôt at Bristol for a considerable period, after having over 21 years' experience at the head office and works of Simplex Conduits, Ltd.

Mr. F. M. Jones, formerly of the B.T.H. Co., contract department, Rugby, and lately assistant general manager to Messrs. Boving & Co. and Electro-Metals, Ltd., is joining the staff of Messrs. W. H. Allen, Sons & Co., of Bedford, at the end of this month.

Wills.—The late Sir Francis Henry Barker, a director of the Metropolitan-Vickers Electrical Co., Ltd., and other companies, left £118,801.

Mr. John Gibson, of Eccles (of the Metropolitan-Vickers Electrical Co.), whose death we announced recently, left £1,402.

NEW COMPANIES REGISTERED.

J. B. Bower & Co., Ltd. (180,937).—Private company. Registered April 5th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in electrical apparatus, machines, accessories, and goods at Wimbledon or elsewhere, and to acquire the business carried on by the Wimbledon Electrical Co., Ltd.. The first directors are:—J. P. Wallis Trevone, Effingham Road, Surbiton, flour merchant; J. B. Bower, 17, Church Lane, Merton Park, Wimbledon, S.W.19, engineer, both directors of Wimbledon Electrical Co., Ltd.; O. O. Dale, "Heath Side," Crook Log, Bexley Heath. J. B. Bower is managing and permanent director. Qualification of permanent director, one share; of other directors, 100 ordinary shares. Remuneration of managing director, as fixed by board; of other directors, £50 each per annum (chairman £75). Registered office, 15, Kingston Road, Wimbledon, S.W.19.

Lighting and Power Finance Corporation, Ltd. (181,031).—Private company. Registered April 8th. Capital, £2,000 in 1,800 preference shares of £1 each and 4,000 ordinary shares of 1s. each. To carry on any trade connected with electric lighting, electrical distribution for light, heat, and power, electrical and general engineering, building, and contracting, for the supply and construction of electrical and engineering works, and also to act as financiers, underwriters, stock and share brokers, &c. The subscribers (each with 20 preference shares) are:—R. E. Lenon, 139, Cannon Street, E.C., electrician; W. C. Green, 20, Abchurch Lane, E.C., engineer. The subscribers are to appoint the first directors. Qualification, £20. Remuneration of managing director not less than £250 per annum. Registered office, 20, Abchurch Lane, E.C.

British Bock Bearings, Ltd. (181,022).—Private company. Registered April 8th. Capital, £50,000 in £1 shares. To acquire rights under certain patents for inventions relating to roller bearings and machines for grinding the rolls of roller bearings, together with the exclusive licence from the Bock Bearing Co., Inc. (incorporated in Toledo, Ohio, U.S.A.), and to carry on the business of manufacturers of and dealers in roller bearings and steam, electrical, petrol, or other engines, carriages, wagons, &c. The first directors are:—W. T. MacLellan, C.B.E., 5, Langham Street, W.1 (director P. & W. MacLellan, Ltd., Bengal Iron Co., Ltd., and Lancashire Wire Co., Ltd.); G. H. Thomson, 3, Princes Terrace, Glasgow (director P. and W. MacLellan, Ltd.); T. Simpson, 36, The Vale, Golders Green, N.W.11. Qualification and remuneration as fixed by the company. Solicitors: Hargrove & Co., 16, Victoria Street, S.W.1.

Electricity Concessions (Ireland), Ltd.—Private company. Registered in Dublin, April 8th. Capital, £1,919 in 380 shares of £5 each and 380 shares of 1s. To acquire the business of electrical engineers and contractors carried on by A. D. Brown at Municipal Buildings, Blackrock, as the "Irish Overseas Direct Trading and Engineers' Association." The first directors are:—A. Brown, 6, Mulgrave Terrace, Kingstown, engineer; D. J. Byrne, 12, Main Street, Blackrock, co. Dublin, property owner. Secretary: G. J. Crowe. Registered office: Municipal Buildings, Blackrock, co. Dublin.

Watson's Electric Co., Ltd. (181,015).—Private company. Registered April 7th. Capital, £1,000 in 400 7 per cent. cumulative preference and 600 ordinary shares of £1 each. To adopt an agreement with F. Watson and G. Bennett, and to carry on the business of manufacturers of and dealers in electric lighting and starting sets and accessories for motor and other vehicles, vessels, and aircraft, &c. The first directors are:—A. Farmer, 12, The Rise, Palmers Green, N.13; F. Watson, 175, Masterman Road, East Ham, Essex; G. Bennett, 15, Brampton Road, East Ham, Essex. Qualification, £25. Remuneration of chairman, £10 per annum; of other directors, £5 each per annum. Secretary: F. Watson. Registered office, 11, Northumberland Alley, Fenchurch Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Nairobi Electric Power and Lighting Co., Ltd.—Satisfaction to the extent of £12,000 (being balance outstanding) on March 31st, 1922, of debentures dated September 10th, 1913, and July 20th, 1915, securing £20,000.

County of London Electric Supply Co., Ltd.—Trust deed, dated March 23rd, 1922, to secure £500,000 debenture stock, charged on the company's undertaking and property, present and future, including uncalled capital, but excluding company's property at Barking, subject to prior debentures securing first and second debenture stocks. Trustees: Trustees Corporation, Ltd., Winchester House, Old Broad Street, E.C.

Northampton Electric Light and Power Co., Ltd. (28,640).—Return dated March 10th, 1922. Capital, £250,000 in £1 shares (10 "A," 212,601 "B" ordinary, and 37,389 "B" preference). All shares taken up. £250,000 paid. Mortgages and charges, £110,000. The capital was increased to £350,000 on March 27th by the creation of a further 100,000 shares of £1 each.

St. Austell and District Electric Lighting and Power Co., Ltd. (66,382).—Return dated October 31st, 1921. Capital, £10,000 in £1 shares (3,000 preference and 7,000 ordinary). 3,000 preference and 4,887 ordinary shares taken up. £7,887 paid. Mortgages and charges, £3,800.

CITY NOTES.

Edison Swan Electric Co., Ltd.

The annual meeting was held at Winchester House, London, on April 11th. Mr. C. Jermyn Ford, who presided, first dealt with some items in the balance sheet. He said the debenture stock sinking fund had been still further increased, and now amounted to £42,778, which was in the nature of a reserve, in addition to the general reserve account of £55,000. Sundry creditors amounted to £391,810, against £428,000 in the previous year, but this had been largely reduced, and at the present time they stood at approximately £275,000. Loans were largely increased. Freehold property figured at £194,000, an increase of £47,000, and plant and machinery had been increased by £35,000, both due mainly to additions to the lamp works and meter works. Stocks had come down from £900,000 to £618,000. Sundry debtors appeared at £214,000, which was £150,000 less than they were in the previous year, due to slackness of trade. The period covered by the accounts had been disastrous; indeed, the most disastrous for industry which this country, and, in fact, the commercial world had ever known. It was anticipated, and reasonably anticipated, that after the devastation and check to production caused by the war a lengthy period of industrial activity and prosperity was in store. Up to the end of 1920 this hope seemed to be fulfilled and the whole commercial world had accumulated stocks of raw materials and manufactured goods in anticipation of the continuance of the greatest industrial activity. How these hopes were suddenly dissipated by the tremendous slump which came so unexpectedly upon us was unfortunately prominently before all of them. These misfortunes were accentuated, if not to a great extent brought about, so far as this country was concerned, by several causes which might have been avoided if only saner counsels had been allowed to operate. The first trouble arose, as they might remember, with the strike of the moulders, the second was the disastrous coal strike, which affected not only all of them as individuals, but every industry in the kingdom, and caused losses of millions of pounds which would otherwise have been available for industry generally. The third cause, which particularly affected that company, which was not possibly appreciated by the ordinary public, was the strike of the shipwrights, followed by that of the ship joiners, which affected all our largest ports, and continued for close upon twelve months, until August last. During its continuance large numbers of vessels which, in the ordinary course, would have been fitted out in home ports, had to be sent to the Continent for the purpose, resulting in a great loss of trade to the country. The loss shown by the accounts was heavy, and it was poor consolation to remark that hundreds of other industrial concerns were in a similar position to themselves. This loss was largely attributable to two causes, the greater being the unprecedented fall in values of all the raw materials and manufactured goods which had occurred during the period covered by the accounts, the other being due to stagnation in trade. The fall which had taken place in values of all raw materials and manufactured goods particularly of the class dealt with by this company, had been extraordinary and unprecedented, and varied from 20 to 75 per cent., and the directors felt that the position, being as it was, it had to be seriously faced. That being so, they had made a most careful and minute valuation of their stocks, both in this country and abroad, and the figures at which they appeared in the balance sheet, viz., £618,000, represented the bed-rock prices. This depreciation amounted to £346,000, and was responsible for the greater part of the loss shown. In arriving at these values the most conservative attitude had been adopted, and all doubtful stocks had been absolutely eliminated, which ensured that at whatever price they were able eventually to realise them it would be to the good. For the purpose of any refund which might be obtained on Excess Profits Duty paid, the Government fixed the date for stock values at August 31st last, and these values were, therefore, those which were current at that date. One could not say at this moment whether there would still be a fall in values, but it was to be trusted that prices had touched bottom. The Board had explored every avenue within the company's organisation for economies, but the accounts had only benefited to a small extent. If a cut price was carried too far the danger line was approached, and they would then not be prepared for any revival of trade. During the period covered by the accounts the company, in common with other manufacturers of electric lamps, reduced the price of its lamps 15 per cent., which cost it £26,000 in hard cash. That, they would agree, was a most unfortunate circumstance, coming at a time when money was scarce and losses had otherwise occurred. With reference to the German competition, those who were not closely in touch with industrial concerns could hardly understand the full burden of that competition, but it did seem unfair that British workshops should be kept idle by German competition and British doles

should have to be given out of the ratepayers' pockets in consequence. Another cause of trade depression was unquestionably high income tax, the iniquitous Corporation tax, and the high local rates. There was one bright spot, he was glad to allude to, and that was their lamp works, which had been progressing most satisfactorily. They had introduced two new types of lamp. One was the "Fullolite" [not "Fullerlite" as appeared in the report of the meeting published in our advertisement pages last week.—EDS. E.R.] which was destined to obviate all glare, and that had caught on beyond their most sanguine expectations. The other was the Daylight Lamp, constructed of specially tinted glass, which gave a daylight effect, and was of great use in all cases where the question of colours came into play. Considering the slack times, the lamp sales had been good, and this branch of the business should largely develop, and they were now thoroughly equipped to deal with it. Loans from bankers had been increased to £223,800, and since the date of the accounts there had been a still further increase, and the amount now stood at £313,950, but without their bankers' assistance they would have been placed in a serious position. The board had been asked whether it intended to have a reconstruction scheme. It had given the matter consideration and obtained the views of some of the largest shareholders, who felt that no good purpose would be served by bringing forward a scheme at this juncture, and in this view the Board agreed. He was pleased to say that Mr. A. F. Berry had consented to join the board of directors. The board would meet its difficulties with a calm view of the future, and he was convinced that with a moderate revival of trade they ought to do fairly well.

MR. E. C. QUILTER seconded the resolution, and said he trusted the shareholders would give the board their assistance and absolute confidence.

The resolution was carried.

The following resolution was also passed: "That the payment of the half-year's dividend of 7 per cent. per annum upon the first participating preference shares to January 31st, 1921, be and is hereby confirmed; and that the payment of the half-year's interest upon the preference shares to July 31st, 1921, be and is hereby confirmed."

Votes of thanks to the chairman and the staff terminated the meeting.

Swiss Companies.

The Oerlikon Accumulator Works Co. intends to pay a dividend at the rate of 20 per cent. out of net profits of 615,000 fr. for 1921, being the same rate as in 1920, when the net profits were 817,000 fr.

The report for 1921 of the Aluminium Industry Co., of Neuhausen, to which reference was recently made, attributes the reduction in the dividend from 16 per cent. in 1920 to 8 per cent. last year to the heavy decline in the sale prices, inadequate turnover, and the difficulties encountered in quickly bringing about a reduction in the costs of production in Switzerland. As to the first-mentioned cause, it is stated that the sale prices in recent months have approximately fallen to the pre-war level, but the contest for markets has not in any way come to an end. During the past year it was possible to secure the removal of the still existing requisition of the works' installations and of individual mines of the French subsidiary companies. Working at the bauxite mines had been resumed, but the Alumina Works required fundamental restoration, and claims for equivalent compensation had been made. Concerning the bauxite company, in Transylvania, the report mentions that this undertaking had been reconstructed according to Rumanian law and with the assistance of Rumanian circles; but the production had not yet been restarted owing to the disorganisation of the transport conditions. It had, however, been possible for the Alumina Works to increase its output. The share capital of the Neuhausen company remains at 42,000,000 fr., as in each of the two preceding years; the net profits, as previously mentioned, were 3,865,000 fr., including the balance forward, as contrasted with 7,629,444 fr. in 1920. A new participation appears among the investments in the form of the Aluminium Rolling Mills Co., of Schaffhausen.

German Companies.

The *Electricity Supply Co.*, of Berlin, records an increase in the net profits from 4,631,000 marks in 1920 to 5,175,000 marks last year, and an advance in the rate of dividend from 14 to 16 per cent. in the two years respectively. The share capital is now to be raised by 20,000,000 to 50,000,000 marks and 6 per cent. preference shares issued for 5,000,000 marks, each having ten votes.

The directors of *Siemens Elektrische Betriebe A.G.*, of Hamburg, which is financially interested in many electricity supply works, report (in accordance with the Commercial Code) the loss of one-half of the share capital through exchange debts, particularly with regard to the company's loans in Swiss francs. The ordinary share capital is 40,000,000 marks and the Swiss loan amounts to 20,000,000 fr. Brief reference to this matter has already appeared in these pages.

The directors of the *Mix & Genest Telephone and Telegraph Works Co.*, of Schoneberg, recommend a dividend at the rate of 16 per cent. for 1921, as compared with 15 per cent. in the preceding year. At the same time it is proposed to increase the ordinary share capital by 15,000,000 to 40,200,000 marks, and also to make an issue of 6,000,000 marks in 6 per cent. cumulative preference shares, each having six votes.

The *Saxony Works, Light & Power Co.*, of Dresden, reports gross profits of 40,110,000 marks for 1921, as against 17,010,000 marks in the preceding year. After having written off 10,850,000 marks for depreciation, as compared with 8,940,000 marks, it is intended to pay a dividend at the rate of 20 per cent. on the share capital of 72,000,000 marks, this result contrasting with 16 per cent. on 40,000,000 marks in 1920.

The *Wireless Oversea Communication (Ueberseeverkehr) Co.*, of Berlin, reports an increase in the traffic from the stations at Nauen and Eilvese in 1921, particularly with the United States and European countries. The directors mention the community of interests concluded with the Radio Corporation and the international arrangements respecting the joint erection and working of the Transradio Argentina, near Buenos Aires. After setting aside 2,926,000 marks for depreciation and maintenance funds, the accounts show net profits of 3,445,000 marks, permitting of the payment of a dividend at the rate of 12 per cent. on share capital of 25,000,000 marks. It is intended to double the ordinary share capital by making a fresh issue of 25,000,000 marks, and to issue 5,000,000 marks in 6 per cent. preference shares, each having 10 votes, and debentures for 25,000,000 marks.

The *Bergmann Elektricitats Werke Gesellschaft*, of Berlin, reports a net profit of no less than 19,573,448 marks for the last financial year, as compared with only 13,068,371 marks in 1920. The dividend on the old shares is being increased from 15 to 20 per cent., while the holders of the new shares are to receive 10 per cent. It is proposed to still further increase the capital, the new shares to be offered at a premium of 320 per cent.

French Companies.

The Société Versaillaise de Tramways électriques et de Distribution d'Energie intends to raise its capital by a further issue, which is being made this month, of 2,000,000 250-fr. shares, in order to set up new supply lines for its distribution networks. The company has just declared dividends for the past year at the rate of 22.50 fr. to the preference shares, 20 fr. to the ordinary shares, and 7.50 to shares *de jouissance*.

Compagnie Française des Câbles Télégraphiques.—The shareholders have confirmed in an extraordinary meeting the increase of the capital proposed in November last, of 8,000,000 fr. in 250-fr. shares, payable in metal. The company's capital is now 24,000,000 fr.

Indo-European Telegraph Co., Ltd.—The directors hope to be able to furnish the accounts for 1921 in the course of two or three months. At the general meeting to be held on Wednesday next the directors will recommend a final dividend of £1 2s. 6d. per share, free of tax, for 1921, making, with the interim dividend already paid, 7 per cent. for the year. The accounts for 1919 and for 1920 will be brought up for confirmation at the meeting. The year 1921 was devoted to the organisation of staff and to the accumulation and distribution of material for the reconstruction of the line in anticipation of its re-opening as a whole, and there is little further of interest to report. There are, however, at this moment certain important developments which the directors hope to report to the meeting.

Jarrow & District Electric Traction Co., Ltd.—The total revenue for 1921 was £14,624, a decrease of £1,908. After deducting all expenses chargeable to revenue, including interest on debentures, and putting £800 to renewals, there remains a surplus of £1,156, plus £4,219 brought forward. A dividend of 4 per cent. for the year on the ordinary shares requires £2,397, leaving £2,977 to be carried forward. The coal strike and trade depression in the district adversely affected the revenue. The Minister of Transport having expressed the opinion that it is in the public interest that through running of cars on the tramways of the South Shields Corporation and the company should be put into operation, the directors hope to make satisfactory arrangements with the Corporation for the early inauguration of through services.

City Electric Light Co., Ltd. (Brisbane).—In their report for the year ended January 31st, 1922, the directors state that, after making additions to the franchise and purchase sinking fund, and renewal, replacement and contingencies account, and contributing to the employés' provident fund, there remains a credit balance of £77,359, which, with the balance brought forward, makes a sum of £77,541. Out of this year's profits the directors paid an interim dividend with dividend duty in September amounting to £34,506, and they recommended in January a further dividend of 3 per cent. on the 6 per cent. preference shares, 3½ per cent. on the 7 per cent. preference shares, and 5 per cent. on the ordinary shares, free of State tax. The payment of the recommended dividend, together with the dividend duty and an allowance for Federal tax, will absorb £42,925, leaving £109 to be carried forward.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Barcelona Traction, Light & Power.—£823,300 7 per cent. 50-year prior lien "A" bonds (Nos. 4,368 to 12,600).

Companies to be Struck off the Register.—The following are to be struck off the register within three months unless cause is shown to the contrary:—

British Sherardisers, Ltd.
Denton Electrical Construction Co., Ltd.
Derby Lamp Works, Ltd.
Electric Timekeepers, Ltd.
Electro-Galvanizers, Ltd.
E.M.F. (1914), Ltd.
Holmquist Electric Co. (1911), Ltd.
Londonderry-Moville Electric Railway Syndicate, Ltd.
Roger Dawson, Ltd.
Sandbanks Railless Electric Car Co., Ltd.
South-Western Vacuum Cleaner Co., Ltd.
Standard Turbine Co., Ltd.
Swanage Electricity Supply Co., Ltd.
United States Railless Electric Traction Co., Ltd.

Wycombe (Borough) Electric Light and Power Co., Ltd.—During 1921 the connections advanced from 3,519 to 3,661 kW. Gross profit on trading, including contracting business, £17,004 (compared with £16,993). After paying debenture and loan interest, &c., paying 10 per cent. dividend on the shares for the year, putting £5,000 to the renewal reserve fund, and £4,000 to general reserve fund, £276 is to be carried forward. Additional plant, costing £15,000, is now being installed to meet the increasing demand, and an issue of 3,000 £5 cum. 10 per cent. preference shares is to be made. Mr. J. C. Wigham has retired from the board and Mr. A. N. Rye has been elected in his place.

Winnipeg Electric Railway Co.—Gross earnings from operations for 1921, $5,418,024; operating expenses, before charging depreciation, $3,559,380; leaving net operating revenue, $1,858,644; plus miscellaneous income, $161,406; making $2,020,050. Deducting interest charges on debenture stock, bonds, gold, notes, &c., $633,331; extinguishment of discount on securities, $52,526; city percentage and car licence taxes, $183,070; taxes, $164,314; miscellaneous non-operating expenses, $3,312; and other income deductions, $54,532; net income, excluding depreciation, was $928,965; an increase for year of $132,389.—*Financier.*

Windsor Electrical Installation Co., Ltd.—At the annual meeting, on April 5th, Sir William Shipley, who presided, said that the balance, after providing for debenture interest, preference dividend, &c., was £3,204, out of which it was proposed to pay a dividend of 4 per cent., less income tax, on the ordinary shares; £1,804 would be carried forward. The profit for the year was smaller, notwithstanding an increase of £2,000 in revenue. They had had to pay more for their bulk supply from the Slough & Datchet Co. owing to the cost of coal.

Slough and Datchet Electric Supply Co., Ltd.—Capt. C. J. Jackaman, presiding at the annual meeting on April 5th, reported a revenue of £31,106, an increase of £4,442. The net profit available for distribution was £8,930. This was divided as follows: depreciation and reserve, £3,000; a dividend of 6 per cent., less tax; directors' fees; carried forward, £2,839. Capital expenditure amounted to £10,000, and included the provision of an additional boiler and new mains.

Folkestone Electricity Supply Co., Ltd.—The annual meeting was held on April 7th, Alderman G. Spurgen, J.P., presiding. It was stated that the gross profit showed an increase of £2,767. Subject to the consent of the Electricity Commissioners it was proposed to pay a dividend of 4¾ per cent. on the ordinary shares. Substantial improvements were in hand and some of the new plant was already running.

Reduction of Capital.—J. G. White & Co., Ltd.—A petition for the confirmation of the reduction of capital from £500,000 to £350,000 has been presented to the High Court and will be heard in London on May 9th.

Monte Video Telephone Co., Ltd.—An interim dividend on the ordinary shares at the rate of 6 per cent. per annum, free of tax, for the half-year is announced.

Tilling-Stevens Motors, Ltd.—The *Financier* states that the directors report a loss on the year's working of £148,212. The balance brought forward was £18,170, leaving to the debit of profit and loss account £166,382. Abnormal trade conditions prevailed throughout the whole of the year. In addition, stocks in hand were taken at market prices and were considerably lower than actual costs.

Broit, Ltd.—The directors' report for 1921 (as quoted in the financial Press) states that trading has resulted in a loss of £23,808, after providing ample depreciation of buildings, plant and machinery, and making due provision for all bad and doubtful debts. Deducting the surplus of £1,758 brought forward there is a net deficiency of £22,049 to be carried forward.

North of Scotland Electric Light & Power Co., Ltd.—Balance on working during 1921, £7,776, plus £634 brought forward. After paying 10 per cent. on the preference shares, and 1¼ per cent. on the ordinary, £4,500 is put to renewal reserve, carrying forward £785.

River Plate Electricity Co., Ltd.—Dividend 7 per cent. for 1921 on the ordinary shares, £10,000 to reserve, carrying forward £9,104. It is recommended that £49,573, part of the reserve, be capitalised and divided among ordinary stockholders.

STOCKS AND SHARES.

Tuesday Evening.

Everybody supposed that the Bank Rate would be reduced on the Thursday in this present week. The Bank of England provided a dramatic and wholly unexpected surprise by lowering the rate to 4 per cent. on the eve of Good Friday. The immediate effect electrified the markets. Investment stocks became more than ever difficult to buy. Second as well as first-class descriptions advanced further in price. An illustration of the way in which the pendulum swung is provided by Whitehall Electric debentures which, 2¾ discount a week ago, rallied to 10s. discount. The preference shares, 92 per cent. of them left with the underwriters, went up from 2s. 9d. discount to 1s. discount. The underwriters, some of whom felt far from happy at first, are now regarding their shares with more calmness than is possible, for example, to anyone trying to write about them, with a vigorous game of ping-pong going on, and a gramophone grinding out fox-trots and jazz.

Cable stocks and shares stand out with peculiar strength where nearly everything is strong. Carefully deliberated advice to buy these issues, offered here from time to time, is fully justified by the rise in Eastern ordinary stock to 193¼, in Westerns and Eastern Extensions to 19¼. Globe followed suit as a matter of course. Anglo-American Telegraph preferred is within a couple of points over par. Telephone prices have advanced with those of the cable companies. Orientals and United River Plate Telephones are better. Jutland debenture is 1¼ higher at 5¾ premium.

Nor is there any reason why these prices should not be maintained. The one thing that might bring about a reaction in Stock Exchange securities is a revival in trade. This would lead to money being withdrawn from stocks and shares in order that it might be utilised industrially. With the Bank Rate down to 4 per cent., an impetus will be given to trade, and the Genoa Conference may do something to help in the straightening-out of the foreign exchange problems. Nevertheless, the trade outlook, brighter though it be, is not sufficiently settled to make it a serious competitor to the Stock Exchange markets as a medium for employment of capital. Prices will go better in all sound-class markets, and, as already observed, the demand now is for stocks and shares which, only three months ago, were deemed very second-rate.

The Underground Railway stocks have been exceptionally dull, the reason being a certain amount of profit-taking on the eve of the holiday. Metropolitans and Districts have had so sharp a jump before the present boom started that the reaction is natural, but a recovery in Districts shows that the market undercurrent is good enough to justify expectations of a further improvement by and bye.

Mexican Utilities are booming. There are rises that range from 2 to 10 points in the popular stocks. The Light & Power issues are in active demand. Both classes of bonds have become almost impossible to buy. This has served to bring the preferred shares into notice, and the price rose 10 to 48¼. Following these, the Common shares hardened to 21½. Mexico Trams, Pachuca Fives, and Mexican Electric Fives have strengthened with the rest. British Columbia Electric Railway deferred and preferred stocks are buoyant. Most of the foreign traction bonds and shares are stronger. Brazilian Traction gained no less than 9 points. Anglo-Argentine firsts gave way to 3¼, but the Seconds rose 5s. to 4.

The Edison Swan meeting produced an interesting speech from Mr. Ford, the chairman, who went into some detail to explain the trading loss of £310,000. He admitted that there were few signs at present of any immediate revival in trade, but described the lamp department as the bright spot in the situation. No change has taken place in the prices of the company's shares. General Electric ordinary at 22s. 9d. are 1s. 9d. better on the week.

County of London ordinary, now split into £1 shares, are 25s. bid, equivalent to 12½ for the £10 shares. The preference hardened to 20s., which is equal, of course, to £10. London Electrics rose ¼ to 1 11/16. Kensington ordinary at 6¾ have recovered part of their recently-deducted dividend. The list throughout shows noticeable strength, although prices remain on much the same basis as that of a week ago. Yorkshire ordinary at 9½ are 5s. better, and the new Yorkshire Power preference, which came out at £4, are 4 9/16 for the fully-paid, and 11s. 6d. premium for the partly-paid.

The manufacturing group shows up decidedly well. Although some of the engineering shares are a trifle easier, Babcock & Wilcox going back to 3, the shares in companies connected with cable work have advanced in most cases. Callenders are up to £2, and the preference at 22s. 6d. are 1/16 better. Henley's at 2 1/16 are also the fraction up; the preference rose 2s. 6d. to 4¼. Metropolitan-Vickers preference retain their rise at 2¾, Siemens ordinary are better than they

appear at 27s. 6d. bid, and the preference have gone over 31s. Dealers complain that there is no stock in the market, and they cannot satisfy the dozens of buyers who come to them every day. Electric Constructions at 22s. 6d. are 1s. 9d. better. British Insulated ordinary have risen to £2, making a rise of 3s. 9d. in a fortnight. In preference shares, there is something approaching a famine.

The North Metropolitan 8 per cent. preference remains about 101½. Evidently the investor does not care for the right which the company has to redeem the stock in five years' time at 100. Were it not for this, the price would certainly be standing several points higher. Although the Stock Exchange took on a somewhat dull appearance after the holidays as a result of the possible complications arising at Genoa out of the German-Russian "treaty" (so called), the reduction in the Bank Rate proved far too strong an influence for investment stocks to suffer any decline in company with the more speculative stocks and shares which gave way in various markets. Even rubber shares are looking better, in consequence of the timid hope that has sprung up as to the possibility of a demand arising for the product. Armament shares are good; good, that is to say, as compared with the prices of a few months ago, and an all-round improvement in iron and steel shares testifies to the belief that it will not be long before the industrial troubles are composed in the engineering world. Investment stocks are moving on to the level of a 5 per cent. return. In many cases even this yield is not obtainable from gilt-edged securities, with the consequence that the public are driven to seek higher-yielding industrial stocks and shares for employment of the money which hitherto has been lying in the banks.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	1921.	Price April 18, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	7½	—	£8 0 0
Charing Cross Ordinary	8	9	6½	—	7 4 9
do. do. do. 4½ Pref.	4½	4½	3½	—	6 8 7
Chelsea	5	5	5½	—	5 9 1
City of London	14	14	35/-	—	8 0 0
do. do. 6 per cent. Pref.	6	6	21/-	—	5 14 2
County of London	8	8	1½	+ ⅛	6 8 0
do. do. 5 per cent. Pref.	5	5	1	+ ⅛	6 0 0
Kensington Ordinary	9	10	6½	+ ½	7 17 0
London Electric	2½	4	1½	+ ⅛	7 2 3
do. do. 6 per cent. Pref.	6	6	4½	—	6 16 6
Metropolitan	7	7	4¼	—	7 5 4
do. 4½ per cent. Pref.	4½	4½	3½	—	6 5 2
St. James' and Pall Mall	12	12	7½	—	8 5 6
South London	7	7	9½	—	8 7 0
South Metropolitan Pref.	7	7	1¼	—	6 4 5
Westminster Ordinary	10	10	7	—	7 2 10
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	102	+3½	5 17 8
do. Def.	1½	34/5	22½	+1	7 15 6
Chile Telephone	6	6	5⅛	+⅛	6 1 1
Cuba Sub. Ord.	7	7	8½	+ ⅛	8 4 8
Eastern Extension	10	10	19½	+ ⅜	6 4 0
Eastern Tel. Ord.	10	10	193½	+ 5	6 3 4
Globe Tel. and T. Ord.	10	10	19½	+ ⅜	6 4 0
do. do. Pref.	6	6	11½	+ ⅜	6 7 7
Great Northern Tel.	23	24	31½	+1	7 13 8
Indo-European	10	10	28	—	6 11 7
Marconi	95	15	2⅛	—	6 17 0
Oriental Telephone Ord.	13	13	9½	+ ½	*5 13 0
United R. Plate Tel.	8	8	7½	+ ½	*5 12 8
West India and Panama	Nil	Nil	6/-	—	Nil
Western Telegraph	10	10	19½	+ ½	*5 4 0
Home Rails.					
Central London Ord. Assented	4	4	65	—	6 1 3
Metropolitan	1½	2½	41½	— ½	5 8 5
do. District	Nil	1	34	+ ½	2 18 10
Underground Electric Ordinary	Nil	Nil	22	— ¼	Nil
do. do. "A"	Nil	Nil	7/-	—	Nil
do. do. Income	3	4	75½	—1	*5 4 7
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	8½	— ½	7 17 2
do. do. 2nd Pref.	Nil	5½	4	+ ½	6 17 6
do. do. 5 per cent. Deb.	5	5	77½	—	6 9 0
Brazil Tractions	Nil	Nil	59	+9	Nil
British Columbia Elec. Rly. Pfcs.	5	5	73½	+5	6 16 1
do. do. Preferred	5	98/-	70	+8½	*8 12 2
do. do. Deferred	8	124/-	71½	+7	*8 12 10
do. do. Deb.	4½	4½	74	—	5 18 1
Mexico Trams. 5 per cent. Bonds	Nil	Nil	70½	+7	—
do. do. 6 per cent. Bonds	Nil	Nil	84½	+2	Nil
Mexican Light Common	Nil	Nil	21½	+2	Nil
do. Pref.	Nil	Nil	48½	+10	Nil
do. 1st Bonds	Nil	5	78½	+8	6 7 5
Manufacturing Companies.					
Babcock & Wilcox	15	16	8	— ½	5 6 8
British Aluminium Ord.	10	10	1⅛	—	—
British Insulated Ord.	15	15	2	+1/-	7 10 0
Callenders	5	15	2	+ ⅛	7 10 0
,, 6½ Pref.	6½	6½	1½	+⅛	5 15 7
Crompton Ord.	10	10	15/-	—	13 6 8
Edison-Swan	10	—	4/6	—	—
do. do. 5 per cent. Deb.	5	5	62	—1	8 1 4
Electric Construction	10	10	1½	+1/9	8 17 10
English Electric	8	8	10/6	—	15 12 2
do. Pref.	6	6	16/3	—	7 7 8
Gen. Elec. Pref.	6½	6½	20/9	—	6 5 4
do. Ord.	10	10	22/9	+1/9	8 15 10
Henley	15	15	2⅛	+⅛	7 5 3
do. 4½ Pref.	4½	4½	4½	+ ⅛	5 6 0
ndia-Rubber	10	—	⅛	—	—
Mot.-Vickers Pref.	8	8	28	—	6 14 9
Siemens Ord.	10	10	87/6	—	*7 5 5
Telegraph Co	20	20	34½	—	*4 17 10

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 19th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic .. .. per lb.	8½d.	..
a Ammoniac Sal .. .. .. per ton	£65	..
a Ammonia, Muriate (large crystal) „	£58	..
a Bisulphide of Carbon .. .. „	..	..
a Borax .. .. „	£30	..
a Copper Sulphate .. .. .. „	£27	..
a Potash, Chlorate .. .. .. per lb.	5d. to 5½d.	..
a „ Perchlorate .. .. „	7½d.	..
a Shellac .. .. per cwt	£1y 5s.	10/- dec.
a Sulphur, Sublimed Flowers .. „	£13	..
a „ Lump .. .. .. „	£11	£1 dec.
a Soda, Chlorate .. .. .. per lb.	8½d.	..
a „ Crystals .. .. .. per ton	£7	..
a Sodium Bichromate, casks .. per lb.	5½d.	..
METALS, &c.		
b Aluminium, Ingots .. .. .. per ton	£190	..
b „ Wire .. .. .. per lb.	1/9 to 2/6	..
b „ Sheet .. .. .. „	1/6 to 2/-	..
p Babbitt's Metal and Anti-friction Metal—		..
Grade I .. .. .. per ton net	£147	..
Grade II .. .. .. „ „	£106	..
Grade III .. .. .. „ „	£62	..
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	..
c „ Tubes (solid drawn) .. „	11½d. to 11¾d.	½d. dec.
c „ Wire, basis .. .. „	9¾d.	..
c Copper Tubes (solid drawn) .. „	1/1½	½d. dec.
c „ Bars (best selected) .. per ton	£88	..
c „ Sheet .. .. .. „	£88	..
c „ Rod .. .. .. „	£86	..
d „ (Electrolytic) Bars .. „	£66 10s.	£3 inc.
d „ „ Sheets .. „	£145 10s.	..
d „ „ Wire Rods .. „	£76 10s.	£3 inc.
d „ „ H.C. Wire .. per lb.	9½d.	½d. inc.
f Ebonite Rod .. .. „	4/6	..
f „ Sheet .. .. „	8/-	..
n German Silver Wire .. .. .. „	2/6	..
h Gutta-percha, fine .. .. .. „	1/6	..
h India-rubber, Para fine .. .. „	10½d.	½d. dec.
f Iron Pig (Cleveland Warrants) .. per ton	Nom.	..
l „ Wire, galv. No. 8, P.O. qual. „	£27	..
g Lead, English Pig .. .. .. „	£24	£1 inc.
g Mercury .. .. per bot.	£10 15s. to £11	..
e Mica (in original cases) small .. per lb.	8d. to 8/-	..
e „ „ „ medium .. „	4/- to 8/-	..
e „ „ „ large .. „	10/- to 20/- & up	..
p Phosphor Bronze, plain castings .. „	1/1	..
p „ „ drawn bars and rods „	1/3½	..
p „ „ rolled strip & sheet „	1/3½	..
p „ „ Wire .. .. .. „	1/3	½d. inc.
o Platinum .. .. per oz.	£19 10s.	..
d Silicium Bronze Wire .. .. per lb.	1/1½	½d. inc.
r Steel, Magnet, in bars .. .. „	1/-	..
n Tin, Block (English) .. .. per ton	£152 10s.	£8 10s. inc.
n „ Wire, Nos. 1 to 18 .. .. per lb.	2/-	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

National Association of Supervising Electricians.—On April 11th, Mr. W. E. Highfield, M.I.E.E., read a paper before the Association on "Temporary Expedients," illustrated with lantern slides. The author covered a wide range of subjects, in connection with the installation and erection of electrical plant, from the methods of receiving and unloading the machinery to preparing the foundations, assembling the parts, drying out, and repairing mishaps. The means described for overcoming the various difficulties that arise were exceedingly practical and useful, and numerous shrewd hints and suggestions were given.

25,000 Photographs a Second.—The *Times* Paris correspondent says that a remarkable step forward in the history of kinematography was announced to the Academy of Sciences on April 10th. M. Bull, Assistant Director of the Marey Institute, has succeeded in photographing electric sparks whose duration was only 1-50,000th of a second. M. Bull employs a prism revolving 120 times a second. Images of sparks refracted by the prism are projected on a fixed film every hundredth of a second. Thus there are about 250 photographs of sparks per hundredth of a second.

Wireless Telegraphists' Dispute.—The Board of Trade has taken steps to prevent interruption of British shipping services through the strike of wireless telegraphists. It did not feel justified under the existing conditions of trade in permitting shipping to be held up solely because no certified operators were available. Accordingly the Board's superintendents at the ports have been notified that in the event of a vessel being unable to obtain an operator, the wireless regulations may be waived and the ship permitted to sail, says the *Daily News*.

OUTDOOR SWITCHGEAR.

By J. B. RUDKIN.

The necessity of developing the water power now unutilised, for the most part, in many countries for the production of electric power for railways, lighting, electro-chemistry, and industrial works, has become one of the most important economic problems owing to the comparatively high price of coal of recent years. Many large hydro-electric power stations have been put into operation, and have successfully assisted in the displacement of coal, and have at the same time contributed largely to the industrial progress of the countries concerned. This is especially the case in Switzerland, where, owing to the high price of coal, the electrification of the main railways is rapidly being extended.

The development of the supply of electric power to all parts of the country must follow, one of the main objects of which is the equal distribution of the available supply in both winter and summer. This can only be attained by the linking-up of the generating stations whereby the whole network of the country forms one large system, working on a common bus-bar, and crossing Switzerland from east to west. The economical solution of this problem in consideration of the great distances of the transmission requires correspondingly high transmission voltages, and the Swiss bus-bar has been calculated for a normal working voltage of 110,000, with a possibility of being eventually increased to 135,000 volts.

This constantly increasing working voltage naturally furnished many problems to the designer of the apparatus, and particular attention had to be paid to the construction of oil switches. It was soon perceived, however, that the dimensions of the apparatus, and the distance between the conductors with voltages of 80,000 to 135,000, which must be employed for such transmissions, did not recommend the installation of the apparatus in buildings, with due regard to clearness of observation, security of service, and finally the cost of the building.

There only remained the method of employing switchgear in the open air and unprotected, which has been used in America for some years.

The electrical apparatus manufacturers, Sprecher and Schuh Co., of Aarau, Switzerland, were the first European company to further the construction of such open-air switchgear and apparatus.

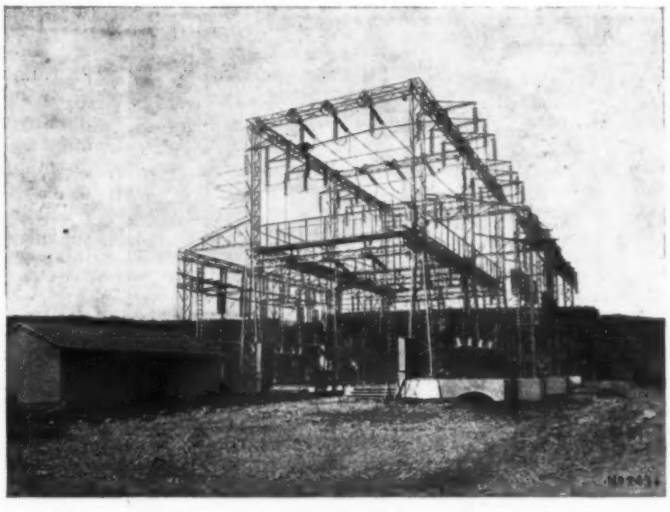


Fig. 1.—Outdoor Switchgear at Goesgen, for a Pressure of 135,000 volts.

Fig. 2.—Single-pole Oil Switch, for 24,000 volts.

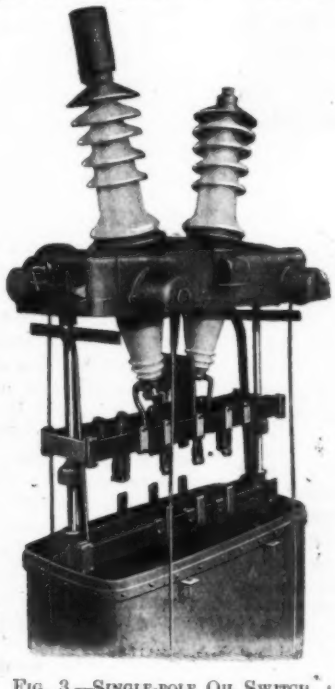


Fig. 3.—Single-pole Oil Switch, for 50,000 volts, with Lowered Oil Tank.

There were many new points to be considered in the construction of the apparatus, and especially the oil switches, such as, for instance, perfect insulation in all weathers, full security of service, even at the lowest winter temperature, large distance between live parts in consideration of the liability of short circuits due to foreign bodies (*e.g.*, wings of birds), ample means of disconnection, great speed of switching, and construction of the contact arrangements for obtaining the highest breaking capacity.

This last point leads to the subdivision of the switching distances, *i.e.*, to the application of multiple interruption, complete separation of the phases into single-pole switch units, and the arrangement of the main contacts, which cannot be deformed by the violent stress of a short circuit.

The first large outdoor switch station in Switzerland is that of the Swiss bus-bar at Goesgen for 135,000 volts, built by the Société Suisse pour le Transport et la Distribution d'Electricité S.A., Berne, fitted with apparatus of Sprecher and Schuh. This station is illustrated in fig. 1, and is divided into a middle nave and two side naves.

The high middle lattice structure contains the bus bars, with the necessary isolating switches and service platforms; below is the operating gear of the oil switches, which, however, are normally driven electrically from the controlling house. Both side naves are used for

mounting the oil switches, choking coils and isolating switches for the incoming and outgoing lines.

The other illustrations on p. 567 show a single-pole oil-switch for 24,000 volts, fig. 2, and one for 50,000 volts, fig. 3, with lowered oil tank.

The picture given below, fig. 4, shows an oil-switch group with choking coils and isolating switches. The inclined entrance of the conductors of the oil switches will be seen to be an arrangement which, with small switch dimensions, gives long distance between the live parts lying outside. The points of view already mentioned for the construction of outdoor switchgear inevitably lead to a definite *minimum* limit of pressure, for which these apparatus can be built with full security of service. This limit will lie at about 24,000 volts.

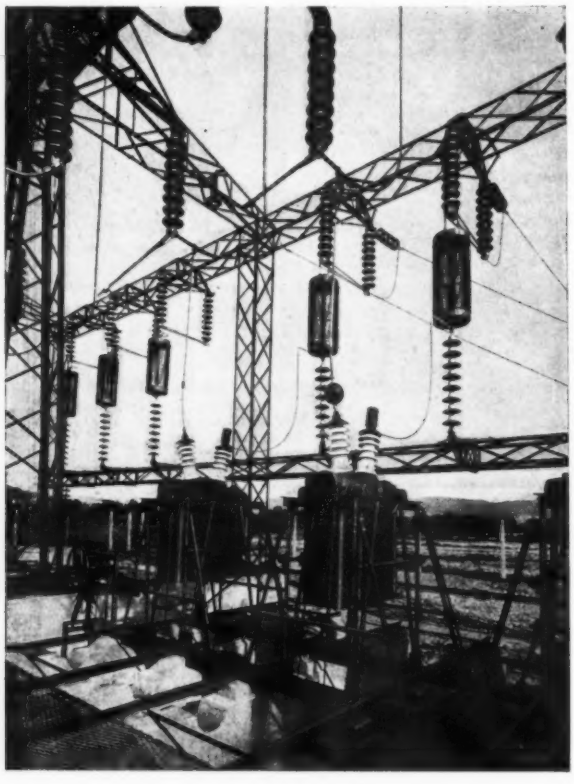


Fig. 4.—Set of Oil Switches with Choking Coils and Isolating Switches. 135,000 volts.

The oil switch in this illustration consists of three single-pole switches with separate tanks coupled mechanically to form one three-pole unit with electrical remote control gear of the solenoid type for outdoor service, the operating panel being located in the attendant's hut. The switches are fitted with direct connected overload time limit relays mounted on the top of the switch, and an ammeter is mounted in the high-pressure circuit, without series transformers.

With regard to the question of the comparative cost of outdoor and indoor installations, including the necessary structures required in each case, from information which Messrs. Sprecher & Schuh have been able to obtain, there appears to be a saving of 25 to 30 per cent. in the case of an outdoor installation, as against the same outfit in the usual "indoor" arrangement. The maximum saving applies to stations for 50,000 volts and upwards. The saving decreases as the voltage decreases, and equal cost will be arrived at with 24,000 volts.

This information appears to be confirmed by American experience, and according to a recent report of the chief engineer of the West Penn. Power Co., Pittsburgh, this company has decided to build all its new 25,000-volt switching stations as outdoor stations.

JIGS FOR ELECTRICAL WORK.

By JAMES EDGAR.

Are machining jigs as much used in electrical shops as they might be? The writer is tempted to ask the question because in recent visits to works of this kind he has seen many jobs on machine tables being drilled and bored after having come from the marking-off table that could quite well have been machined in jigs, not only lowering production costs but ensuring greater accuracy in final erection. The setting of a casting on a machine table is nearly always a tedious process, requiring great skill, and the results are seldom as satisfactory as when a jig has been used. The jib ensures interchangeability quite apart from the skill of the operator, and in the manufacture of duplicate parts is of great assistance.

It is not proposed to discuss the designing of jigs here, but simply their suitability to what may be termed medium sized and large electrical work. It is too often supposed that a jig is only profitable if a large number of castings are required, but this is not so. We know of one firm of large Diesel oil engine makers which has reduced jig use to a fine art, and finds it profitable to make a jig that will only be used a few times. It is possible by the exercise of a little ingenuity to make one jig suitable for one or two operations, and sometimes to use two jigs in conjunction to machine one part.

The works manager of an electrical manufacturing concern confessed to the writer recently that jigs were not as much used in the works as they might be, but he did not suggest a cause. One wonders if it is that firms are so much concerned about perfecting designs that they in some measure overlook the importance of manufacturing details. Good machines are installed, but the greatest use is not made of them.

The petrol engine has been more responsible for the development of the jig system of machining than perhaps any other factor. Foreign competition may have had something to do with this, but the electrical engineer is also faced with foreign competition. With the rise of the motor car there came the necessity not only for precision methods, but also for cheap and quick production. Gradually engineers concerned with other than petrol engines have seen the advantage of jigs, and now in almost every department of small engineering the jig has displaced to a great extent the marking-off table, and jigs have become simplified and perfected. The jig designer is now installed in most engineering works.

It should be remembered that the economy of using jigs does not end in the machine shop. Indeed, it only begins there. The time saved by jig-machined work in its passage through the various departments is incalculable, apart from the greater satisfaction obtained.

It is quite wrong to suppose that jigs are not suitable for large work. In lowered handling charges alone, a jig soon pays for itself, whilst less skilled labour can be employed. When a jig has been so designed that the work is easily inserted and quickly withdrawn, and when the clamping is arranged so that no damage is done to the casting, a mistake on the part of the machine operator is scarcely possible.

The planning department of a modern works can easily tell whether a jig will be profitable or not. It does seem a pity that works which are admirably laid out and splendidly equipped with modern machinery should fail to reach the highest production because of a persistent belief that jigs may be suitable for internal-combustion engines but nothing else. Many castings used in big electrical work are suitable in every way for the employment of jigs.

The Floating Exhibition.—Owing to the dispute in the engineering industry the sailing of the steamer *British Trade* has been postponed from May 1st to June. The vessel is to undertake a voyage of about 38,000 miles, and it will call at a number of the chief ports of the world, including Buenos Aires, Rio de Janeiro, Montevideo, and numerous Empire ports. The voyage will occupy from eight to nine months.

ELECTRIC MOTOR STARTERS.

[*Abstracts of papers and discussions before the* Institution of Electrical Engineers.]

The British Engineering Standards Association felt that much benefit to all parties concerned would arise from a discussion of the specifications that have been framed by a Committee under the chairmanship of Mr. C. H. Wordingham, C.B.E., in their draft form before they were issued to the public, as it was thought that the Committee would be likely to receive valuable suggestions from manufacturers and users which might enable it to improve the specifications before they were issued.

Accordingly, at a recent meeting of the Institution of Electrical Engineers, three papers on the subject were presented and discussed, of which the following are abstracts.

British Standard Specifications for Motor Starters.

By C. H. WORDINGHAM, C.B.E., PAST PRESIDENT.

A request for standardisation with regard to motors starters led to the formation by the British Engineering Standards Association in 1914 of a committee under the chairmanship of the author. The following definition of a motor starter was adopted:—

"The term 'motor starter' denotes a device arranged for stating and accelerating a motor to normal speed, but not adapted for use in positions intermediate between the 'off' position and the 'full-on' position."

The corresponding definition of a motor controller is as follows:—

"A controller is a device having several steps, contacts or positions, sometimes called notches, used with or without resistances, for regulating the speed of a motor or motors, and may or may not be used for starting. The term 'controller' does not include the resistances or other means of control employed therewith.

"Simple shunt regulators are not included in this definition."

A specification for face-plate rheostatic starters was prepared and issued first. It was found necessary to discriminate between ordinary duty and heavy duty starters, the frequency of starting being the same in both, and the difference being in the starting periods. The committee was greatly helped by Mr. G. H. Roberts, C.B.E., who made trials on starters actually in use and known to behave satisfactorily at Woolwich.

The committee was very anxious to provide interchangeability of contacts and centres of fixing holes, but the makers have not found it possible at the present time to get sufficient agreement among themselves with regard to these points.

On completion of the specification for face-plate starters the following specifications were commenced, the Panel Committee responsible for their preparation being under Mr. G. H. Roberts's able chairmanship: Drum starters, liquid starters, switch starters, multiple switch starters, contactor starters, auto-transformer (compensator) starters. These specifications are still in draft form and are not yet approved for issue, but proofs are available for all desirous of taking part in this discussion.

When the British standard specification for face-plate starters was first issued it was generally agreed that after use for a year or two this first attempt at a definite standard for the rating of motor starters might need revision. In the preparation of the remaining specifications for motor starters full use is being made of the experience gained in connection with the pioneer specification, and it is intended to revise B.S.S. No. 82 to bring it into conformity with the new ones as soon as they have been issued.

Each draft specification is divided into four main parts, namely: (i) general definitions; (ii) rating, sizes and marking; (iii) design and construction; and (iv) tests.

Mr. Scott Ram pointed out that as the degree of protection necessary for a motor starter to enable it to pass the requirements of the Home Office depended entirely upon the location of electrical apparatus, it was not possible to indicate in a specification whether a starter would or would not comply with the regulations of his department. In some cases "open type" might be approved, and in others "flame-proof" covers might be necessary.

The provision of an overload release on a standard starter has been made optional.

In conclusion, I would emphasise the fact that every B.E.S.A. specification comes up automatically for consideration and, if necessary, for revision each year.

Electric Motor Starters.

By J. ANDERSON, M.I.E.E.

The paper deals with the practical development of an electric motor starter from the first principles relating to current, torque and resistance valves, to the data required by the salesman. First it describes the method adopted of working in percentages for all calculations; defines starting, accelerating and running torques; refers to the lack of data regarding starting conditions; and gives tables of stored energy in rotors, for the normal load torque during acceleration and for the stored energy of a number of typical machines.

A convenient formula is:

$A = s/T \times 5.5 \times K$ where A_t = accelerating time (secs.); s = stored energy at full speed (ft.-lb. per b.h.p.); T = percentage of full-load motor torque available for acceleration; and K = (0.5) constant depending on the shape of the accelerating curve. Accelerations are classified and typical diagrams with automatic contactor and hand-operated starters are given.

When a current is passed through a motor and rotation commences, the speed rises until the back electromotive force cuts down the current to an amount which gives rise to a torque just sufficient to overcome the running friction or load at that speed. When the starter arm is moved to the next notch to cut out resistance there is a current-rush, the peak of which is determined by the ratio of the first resistance to the second, which gradually dies away as the speed and back electromotive force rise until balance is restored and the current corresponding to the running torque at the new speed is flowing. If this is repeated on the third and subsequent notches and all the peaks and valleys are equal, the acceleration is called "natural regular"; "regular" because the peaks and valleys are equal, and "natural" because the valley current corresponds to the running torque and cannot be reduced.

Fig. 1 is drawn for the correct accelerating time on each notch, and these times are in proportion to the ratio of the resistances.

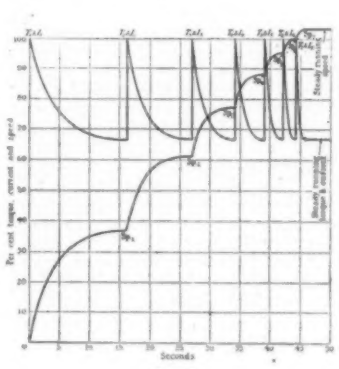


Fig. 1.

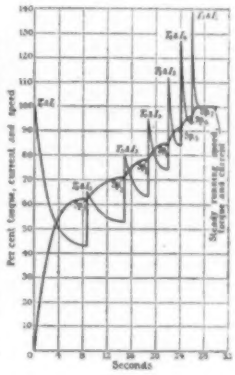


Fig. 2.

Fig. 1.

Torque/time and speed/time curves for 7-notch starter passing 100 per cent. current on last notch with motor having 66.6 per cent. load. Stored energy: 1,000 ft.-lb./b.h.p. Motor resistance: 8.8 per cent. Ratio of resistance from notch to notch: 1.5.

Fig. 2.

Torque/time and speed/time curves for 7-notch starter passing 100 per cent. current on first notch, with motor having centrifugal-pump load starting at 7½ per cent. and rising to 100 per cent. Stored energy: 1,000 ft.-lb./b.h.p. Motor resistance: 8.8 per cent.

Fig. 2 shows the effect of overestimating the motor resistance; it is typical of "natural irregular acceleration"; "natural" because the valleys fall to the running torque and cannot go lower, and "irregular" because the peaks are of unequal value. It is essential to know the resistance of the field and armature for a series motor, and of the armature only for a shunt motor. By armature is meant the total resistance, including brush gear, commutator and connections. The starter maker, in the absence of these data, has deliberately to underestimate the motor resistance, and this frequently means the addition of another notch or two on the starter, with correspondingly increased selling price if the larger dial will go in the same frame, and a very greatly increased price if he has to use the next larger frame.

Fig. 3 is an example of "forced regular acceleration" for the same starter as in fig. 1, but used on a 10 per cent. motor load, transition being made from notch to notch, not when the valley has fallen to the running torque, but prematurely when it has fallen to only 66.6 per cent. of this value; the current falls to the running current only on the last notch when all the resistance is cut out and the operator can no longer in-

fluence the acceleration. Owing to the increased torque available for acceleration the total time is reduced to about 7.06 seconds. An ammeter should be installed with a red mark at the valley current when it is desired to operate a starter in this way, and the operator then traverses the contacts at the right time by passing from notch to notch when the current falls to the mark.

Fig. 4 is an example of "forced irregular acceleration" and is typical of centrifugal hydro-extractors; it is "forced" in

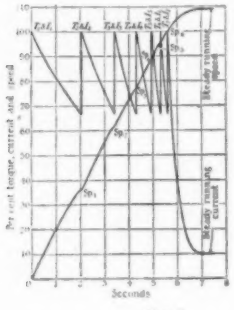


Fig. 3.

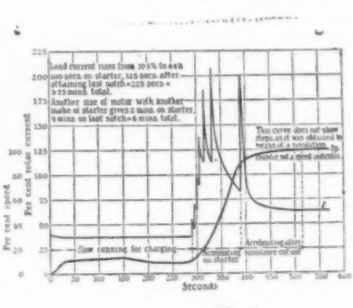


Fig. 4.

Fig. 3.

Torque/time and speed/time curves. Conditions as in fig. 1, except that starter is operated to give a peak on each notch equal to that on notch 1, with consequent "forced regular" acceleration.

Fig. 4.

Speed/time and current/time curves for centrifugal hydro-extractor; 48-inch basket.

the sense that the valleys are never allowed to fall to the running torque, and it is "irregular" in that the peaks and valleys are unequal.

That instinctive knowledge of starting conditions which is essential for the starter maker can only be acquired by each designer working out a series of diagrams for himself until it becomes second nature to visualise the curve and say offhand what proportions must be used for the job.

Regarding the relative merits of current relays and pressure relays across the armature, there is no advantage in a pressure setting *versus* a current setting; on the contrary, the relays must be more difficult to standardise, wind, and adjust.

When estimating the accelerating times, if the running torque is 66 per cent. the excess torque in the time available for acceleration is represented by the area of the peaks, and roughly the average over the period works out at one-quarter of the excess of the peak over the valley, giving in this case $(100 - 66)/4 = 8.5$ per cent.

If this value is inserted in the above formula

$A_t = 1{,}000/8.3 \times 5.5 \times 0.5 = 43.8$ seconds (approx.)

In fig. 3 the peaks and valleys are the same, giving 8.3 per cent. effective torque, but the load torque is only 10 per cent., giving an excess of the valley over the load of 56.6 and making the average effective accelerating torque 64.9 per cent. up to the second last saw tooth; the average of the last saw tooth, falling to 10 per cent. torque, should be worked out separately. The time on the last notch does not affect the resistance, and particular attention need only be paid to it for loads (see fig. 4) where the total accelerating time is of importance and the time with all resistance cut out is a considerable percentage of the total. No claim for accuracy is made for these calculations; they simply show a means of rapidly determining in a commercial manner the general proportions of starters for different classes of work. In this it is far better for the user to state in plain language what he desires to do and give the salient data of the machine he wants to start, than to draw up elaborate specifications full of annoying and useless restrictions.

As a working basis the breaking capacity required from notch to notch is given by the maximum current at the maximum pressure; thus if on notch 2 the current is 10 amperes and the starter arm is moved back to notch 1 and a difference of potential of 10 volts is established between notches 1 and 2, the breaking capacity of the gap should be sufficient to deal with 10 amperes at 10 volts, not 100 watts. The law connecting amperes and volts for a given quick-break switch and a given breaking distance in air is of the order of

$$\frac{(\text{Amperes})_2}{(\text{Amperes})_1} \propto \left[\frac{\text{Volts}_1}{\text{Volts}_2}\right]^{1.5}$$

Continuous rating need scarcely be considered in the case of a pure starter, as it affects speed regulation only. The following remarks apply to the element which consists of a wire of high-resistance alloy, with negligible temperature coefficient, wound on a stoneware cylinder having a spiral groove that supports the wire throughout its length. The more costly the wire the cheaper the whole assembly, as cheap wire entails a larger frame, and the cost of the frame is generally greater than the element it contains.

For continuous rating the temperature-rise depends primarily on the watts dissipated per unit surface of the wire; on the way the wire is shielded by the supports and frame; on the proximity of one turn to another; on the number of turns vertically above each other; on the horizontal distance apart of the elements; and on the side draughts, which are difficult to exclude while permitting free access of air. The slightest shielding or side draught causes the temperature to rise or fall very erratically.

Curiously varying results are obtained with low and high final temperatures, owing to the different radiant components at the two temperatures, and quite different results are obtained if the element is horizontal instead of vertical. A curious effect occurs for which as yet there is no explanation, *i.e.*, the highest temperature-rise occurs at the middle of each element, whether long or short; the temperature rise at the middle of the short element is roughly the same as that one-quarter the way up the longer one; and the temperatures from element to element do not add up. Much the same phenomenon occurs with elements immersed in oil. Radiation curves indicate that columns of elements should be about 1 in. apart. The temperature-rise of the frame is an extremely doubtful figure, but can be taken very roughly as being one-third the temperature-rise of the elements.

Tests on a resistance element totally enclosed show that the effect mentioned for air-cooled resistances shielded from side draughts is considerably modified.

An intermittent rating depends on the watts which will raise the temperature of the unit during the heating period the same number of degrees that it cools during the cooling period. An element with high thermal storage, *i.e.*, specific heat multiplied by weight, is a desideratum for infrequent starting, say once every four hours, and the ability to get rid of the heat is not very important. Consequently, resistances embedded in ceramic material are attractive at first sight.

It seems going rather far to have one type with low thermal capacity and high dissipating capacity for continuous rating, another with high thermal capacity and poor dissipating capacity for infrequent starting, and a third intermediate type for running on a consecutive cycle. The element already described is a satisfactory compromise.

Diagrams for air cooling and radiation and diffusion curves are next dealt with, and reference is made to certain difficulties experienced by salesmen in tabulating the h.p. and resistance sizes.

The currents corresponding to the standard d.c. motor horse-powers rarely agree with those which give the maximum permissible temperature-rise of the elements, so that, for the most part, the resistance units are running far below the maximum.

When it is remembered that the temperature-rises accepted as standard are 350 deg. F., and sometimes only 200, it is obvious that these maxima are far too low and should be more nearly 600 or 700 deg. F., particularly for elements consisting only of metal and china.

A table of horse-powers and resistance sizes correctly worked out presents the apparent paradox of the smaller horse-power frequently requiring the larger and more costly resistance; a correctly worked out table is practically impossible for a.c. slip-ring motors, because there are no standard full-load rotor currents. One result of such low standard temperatures is that British gear is practically unsaleable on the Continent and in South America, and in pre-war days was very difficult to sell in the Overseas Dominions against German and American competition. The same remark applies to cable connections and switchgear generally. The waste of cable in connecting starters is sometimes grotesque.

(To be continued.)

The Design of Liquid Rheostats.

By W. WILSON, B.E., M.Sc., A.M.I.E.E.

This paper (which has already been abstracted in our issue of December 16th, 1921) has for its object the more definite determination of the constants of the liquid rheostat, and the more exact prediction of its performance. First, the phenomena occurring in such a rheostat under a wide variety of circumstances are considered, a distinction being drawn between the behaviour of direct and of alternating currents in the apparatus. Tests are described which bear out and amplify the conclusions, many of which are characterised by the employment, with impunity, of current densities many times larger than those generally considered to fall within the limits of safety.

Representative designs of rheostats, for both small and large horse-powers, are described and criticised. A mathematical method is developed for conveniently arriving at the capacity of a given liquid starter, from thermal considerations, which form the deciding factor in this case. A more elaborate calculation is also given, capable of more general application. The effecting of artificial cooling for liquid controllers is dealt with, descriptions of the pipe-cooled and the adjustable weir types being included.

The functions of a liquid slip-regulator are analysed and the usual pattern is reviewed, the conclusion being reached that it could be simplified with considerable advantage. Finally, suggestions are made with regard to specifications for governing the design and construction of this apparatus.

Discussion at Newcastle-on-Tyne.

At a meeting of members of the North-Eastern Centre of the Institution on February 27th, when Prof. W. M. Thornton presided, two papers on the above subject were considered —namely, that by Mr. J. Anderson, which is abstracted on p. 569, and that by Mr. W. Wilson, which was summarised in our issue of December 16th, 1921.

The Chairman, in opening the discussion, said the real point in either kind of starter was its heating capacity, and Mr. Anderson, amongst his useful figures, had shown that there was some irregularity. Future developments lay in the direction of an automatic starter, for in what the authors had dealt with there was still the human element, and that should be, as far as possible, eliminated from electrical apparatus.

Mr. J. Schuil said the advantage of a liquid starter was its very gradual acceleration, but that feature was to be found in some other types of starter that had not been mentioned; he referred to one in which graphite was used to graduate the resistance, and another type, similar in principle, in which the carbon was mixed with small pieces of mica.

Mr. T. Carter referred to the developments made in starters, and said he thought that the points of difficulty raised with regard to d.c. would in the course of time be met. Even in small sizes he found liquid starters were satisfactory, and in all cases the troubles met with were mainly due to bad usage and neglect—the men working them had no idea as to quantity. As to the strength of liquids, the speaker generally worked upon 10 per cent. or 15 per cent., and that seemed generally satisfactory for starters for 300 or 400 h.p. Starters should be based upon the horse-power-minute principle, and having agreed upon the principle of rating, it should be clearly stated so that persons concerned would know what it meant. One advantage of liquid starters was that one could see more or less what their condition was and what, if anything, was wrong. He was glad that Mr. Wilson referred to what some might regard as a small matter, that was the figure of absorption of h.p., and drew attention to the fact that the figure should be divided by two. The question of design needed to have attention drawn to it. It was extremely difficult to get customers to give details of what they wanted when ordering a starter. The idea that some persons had about torque would be amusing, were it not so serious.

Mr. G. Mallinson said that in the case of shipyard cranes the resistances sometimes lasted six months, but others only lasted three weeks. While many cast-iron grids were satisfactory, others were very troublesome, and the solution seemed to be to use one of good cast iron, as very often the iron used was mixed in the foundry, and was used for resistances "to save money," and it broke the first time it was used. There was an automatic starter already in existence which operated perfectly.

Mr. J. Gibbins agreed as to the difficulty of getting details of construction from the motor makers, and regretted that the practice was becoming more pronounced. Very often the particulars were not obtained until the motors were on the site and bolted down, and then there were delays in starting up. Unfortunately, most engineers looked on the switch as a side line, with the result that many a first-class motor was running unsatisfactorily simply because improper switchgear had been installed. The importance of switchgear could not be over emphasised; in his opinion switchgear was a sort of insurance, and money well spent upon it was a sound investment.

Mr. J. Anderson briefly replied to the discussion, but could not explain why grids broke as they often did. Some were perfect, and others broke by the basketful. One thing they should remember was that they could not fuse them, and the breaking might be due to the heavy current.

Mr. W. Wilson, also in reply, said the reason why they were apt to get a "kick" at the last contact was clearly due to the electrolyte being too weak. He concurred with Mr. Carter's statement that most defects they met with were the result of bad usage. It was amazing how people seemed to think that having got a starter they could leave it alone for months and the apparatus would still work, but there was a time when even a liquid rheostat would "turn." It must have reasonable attention—and water—which some seemed to think was not necessary. He criticised the manner in which liquid rheostats were hampered with regard to the rating. It was necessary to standardise a thing if the industry were to prosper, but unless standardisation were to go hand in hand with development, it would not be standardisation, but stagnation.

Discussion in London.

Mr. Gunton opened the discussion by explaining that progress in the framing of specifications must necessarily be slow, so as not to discourage makers' endeavours to effect improvements. A new feature of the specifications was the introduction of constructional clauses.

Mr. J. L. M. Slater (a member of the B.E.S.A. panel) explained that a thermo-couple temperature measurement was to be preferred for small wire. With regard to electrolytes used in liquid starters, a potash-alum solution gave satisfaction and close speed control, but it had not been mentioned in the paper.

Mr. Foster was of the opinion that the amount of trouble that was experienced with low-voltage coils was not generally appreciated. When such coils were made each should be marked to indicate what it would stand.

Mr. J. T. Mould, who introduced himself as one of the offenders who brought the specifications into being, referred to the reasons why it took so much time to introduce standards, and to the work of the committee. They had to compromise between the ideal and the practicable, and could not ignore what had gone before, nor the results obtained by, and the experience of, makers. They had not to frame new standards, but to co-ordinate those already in existence. It was not possible to give the user all he desired because the maker knew more about the difficulties that were encountered. If the user got what he wanted it would probably be too expensive for him to use.

Mr. Carter pointed out that the proposed rating clause of liquid starters did not mean what it said. Mr. Wilson's specification was better than the B.E.S.A. one. A disadvantage of liquid starters was that the operator was apt to forget to replenish the liquid; moreover, operators did not usually know what a 10 per cent. soda solution was; if it was stated as 1 lb. to the gallon they would understand it.

Mr. J. W. Blaikie queried whether the results of Mr. Wilson's small-scale experiments under a head of liquid would apply to large apparatus wherein the actions took place nearer the surface of the electrolyte. He thought they should differentiate between the terms "low-voltage" and "no voltage" coils.

Mr. A. Dover exhibited curves relating to, and explained the method of calculating, grading coefficients and the resistance of sections.

Mr. H. Brazil suggested that for liquid starters it might be possible to use a material that was intermediate between a liquid and a solid, say, a powder. Preliminary experiments with powdered carbon for such a purpose seemed to indicate that its use would abolish the troubles that Mr. Wilson mentioned when d.c. was used. Such a powder could be used at a higher temperature and, therefore, a higher rating than a liquid.

Mr. J. Anderson, in reply to the discussion, did not think a thermo-couple would give a more correct temperature than a thermometer.

Mr. W. Wilson, also in reply, explained that the ultimate rating was not altered by the upper layers of the electrolyte becoming hot, although that would alter the resistance somewhat. But a liquid starter was not the same as others which had definite steps, each of which should have a definite resistance. He was glad it was intended to revise the proposed specifications annually. Standards must progress with the results of research, or else they would result in enforced stagnation. He did not think it possible for a liquid resistance to break down, unless one or more of the three following conditions obtained: boiling, scum, or long floating of the electrodes.

The discussion was resumed on March 23rd.

Mr. P. Good, a member of the Committee dealing with the matter, stated that practically all of the suggestions made at the previous meeting were eminently good and were being embodied in the draft specifications. He outlined the formation of the B.E.S.A. and its work, paying special attention to the electrical committees. Mr. Carter had objected to the method of rating liquid starters. The rating of any starter was based upon the line characteristics or upon those of the motor to which it was applied. The same basis had accordingly been adopted for the liquid starter. Standardisation was not merely the fixing of dimensions, it included many considerations, not the least important of which was cost.

Mr. C. S. Buyers stated that in one part of the specifications it was stated that no combustible material should be used in the case or frame of a starter. This practically confined makers to porcelain, slate, or mica insulation, and precluded many well-tried materials. Why not employ the word "inflammable" rather than "combustible"? The specifications for liquid starters ought to be extended to cover synchronous induction-motor starters.

Mr. J. C. Bentley said that drum-type starters were gradually replacing the face-plate type. He drew attention to the fact that 15 different methods of enclosure were given; taking this in connection with a fairly large range of ratings and types might give an overwhelming number of different designs. He considered that for all industrial purposes motors up to 50 h.p. should be fitted with totally-enclosed starters. Mr. Bentley thought that making the provision of an overload release optional was a retrograde step. With regard to the temperature limits for coils and resistances, while the wound-coil temperatures specified seemed satisfactory the same could not be said regarding resistance units. These should be allowed a higher continuous rating than 100 deg. C. He considered that there were too many contactor starters, and that the use of slate bases should be discontinued in favour of insulated metal fixing media.

Mr. A. E. Constable, after suggesting that the six specifications should be combined in one volume, pointed out a number of discrepancies which, he stated, he would send in in writing. He said that, although the Admiralty was represented on the Committee, it did not insist that its special requirements should be embodied in the specifications.

Mr. J. W. Sims thought that more should be heard from users of motor starters. He objected to the use of the term "compensated" as applied to auto-transformer starters, stating that compensation implied balance, and the auto-transformer did not balance anything. With regard to markings, these should be more fully given, to enable the user to ascertain the type of motor for which a starter was designed. In the case of a three-wire system he thought that marking the terminals "1, 2, and 3" would lead to trouble—the neutral should be plainly marked.

Mr. Le Maistre (secretary to the B.E.S.A.) said he hoped that these meetings were forerunners of many similar meetings, as opinions expressed in this way were of the utmost value to the Association. The industry owed a great deal to Mr. Wordingham for the enormous amount of work he had done; it was at his suggestion that these meetings had been arranged. He also paid a tribute to the work of Mr. Good. He congratulated the Institution upon being the first of the big engineering societies to open its doors for the discussion of the specifications.

The President regretted that Mr. Wordingham was not present to reply to the discussion. He (the president) would not presume to do so. He would like to express his appreciation of the great care which the Committee had taken to guard against over-elaboration. No attempt had been made to specify materials, which was satisfactory in view of the improvements which were always taking place. He had observed a tendency in the electrical industry to make everything "fool-proof," and he thought this was overdone. Surely they should realise that the men who handled those things knew something about them; if they did not they would soon learn by using apparatus in the wrong way.

Mr. W. Wilson considered the temperature rise permitted in liquid rheostats was too low.

INDUCTION-TYPE SYNCHRONOUS MOTORS.

Discussion at Bristol.

Mr. L. H. Carr's paper on the above subject (which was abstracted in our issue of January 6th, 1922) was read before the Western Centre of the Institution of Electrical Engineers on March 6th, when, in opening the discussion, Major E. I. David (Powell Duffryn Collieries, Ltd.), said that the astonishing fact brought out by the discussions was that although those motors had been made in this country for 10 or 12 years, and abroad for 20 years, no operating experiences were given by any of the speakers at the previous discussions. On the system with which he was connected, a number of synchronous induction motors had been running for some time, the total h.p. being 2,655. A comparison therefore between the running of machines of varying types was possible. Mr. Carr gave the impression that starting a synchronous induction motor was considerably simpler than starting a salient-pole motor, whereas the fact was that the actions were almost identical. Major David exhibited a number of starting curves, and argued that the salient-pole synchronous motor was equally as good as the synchronous induction motor for starting compressors, but the ordinary induction motor was preferable to the synchronous induction motor for starting fans. The efficiency of the salient-pole synchronous motor was normally at least 2 per cent. higher than that of the synchronous induction motor. Two per cent. difference in efficiency on a continuously running machine like a colliery compressor represented something like £300 per annum. On smaller machines, particularly at .8 leading p.f., the difference was still higher, up to 45 per cent. The lower efficiency in the case of the synchronous induction motor was accounted for partly by greater excitation. The claim for the synchronous induction motor of advantage due to the higher pull-out torque as an induction motor was not borne out in practice. The change from synchronous to induction running was accompanied by violent surging. Further, the salient-pole machine would hold in synchronism at full load with a drop of supply voltage up to 50 per cent., whereas 25 per cent. would be about the limit of the synchronous induction motor. The salient-pole motor, owing to its large air gap and rugged rotor construction, was particularly suited for direct coupling to high-speed compressors of the piston type. No intermediate bearing was required, resulting in a saving in length, and the s.p.m. exciter was a normal 110/160-volt machine against a freak 40/50-volt one. The slip rings carried 150/160 amps. against 350/450; the starting gear was very similar; the liquid starter was replaced by an auto-transformer; the same number of switches and other instruments was required. The starting torque was ample for the purpose, and the starting current and kilowatts only slightly greater.

Reliability was essential for mine fan motors. A plain induction motor, with a simple rotor winding not subject to high voltage shocks at starting, was inherently more reliable than the freak rotor of a synchronous induction motor. If power factor improvement was required, a phase advancer, which might be used or not at will, would meet all requirements, and might be added at any time as the mine load developed. If a clutch or other starting device was provided, then a salient-pole machine was preferable to a synchronous induction motor.

Large mining pump motors running at 1,500 or 3,000 r.p.m. had usually power factors of from 93 per cent. to 96 per cent. To obtain a leading p.f. of 0.9 would entail a sacrifice of 2 to 3 per cent. efficiency, and require high rotor starting volts, increased complication, cost, and liability to breakdown. Further, for colliery use the motors would have to be totally enclosed, and all the switchgear flameproof. The reduced reliability would be sufficient to put it out of court in the eyes of a mining engineer. For driving Ilgner sets, or any drive where energy was required from the moving masses during peak loads, the plain induction motor with a phase advancer slip regulator, which could be arranged to give up to 15 per cent. speed drop from light to full load, was preferable. A set of that type was installed in that district driving a rolling mill. Perhaps the plain induction motor without the slip regulator had a p.f. from 5 per cent. to 10 per cent. higher than that of the synchronous induction motor running as an induction motor. In addition to the power-factor improving machines already indicated, Major David had a 236-kVA static condenser also in operation at 3,000 volts, which had given very satisfactory results. He agreed with the author that the s.i.m. could be made a satisfactory and reliable machine, but it was not the superlative machine he endeavoured to prove it to be.

Mr. C. S. Buyers (Messrs. Crompton & Co., Chelmsford) differed in opinion from one or two speakers in that he considered that type of motor, for several reasons, very suitable for driving the main fan at a colliery where the power factor might be as low as 0.6 lagging, a figure which was not uncommon. First, fan motors ran at a fairly low speed and were in many instances underloaded for the first few years to allow for change of pulleys in the future when a greater volume of air became necessary; a synchronous induction motor could be run at a leading power factor at any load, thus rectifying the effect of lagging currents in the system. Secondly, a fan motor ran for six days a week at a constant load, and did not require to be started and stopped frequently, all of which were in favour of the synchronous induction motor. Thirdly, the air gap of a synchronous induction motor was generally greater than that of a plain induction motor, a matter considered of importance by colliery engineers, who rightly regarded reliability as an essential feature of a fan motor. The desirability of using synchronous induction motors where suitable conditions prevailed should be evident if one considered that the losses in a system operating at 0.7 power factor were twice as great as when operating at unity power factor. Mr. Carr did not include in his diagrams, showing the various methods of connecting the rotor windings of synchronous induction motors, the scheme adopted by Messrs. Crompton and Co. Their method was to wind the rotor two-phase and to connect the neutral point of the rotor winding directly in series with the exciter armature, and with the dippers of a two-phase liquid starter, the two free ends of the rotor winding being connected to the insulated pots of the starter. The exciter was always at earth potential at starting, even if the slip-ring voltage were as high as 2,000 volts. With that arrangement the starting apparatus was exactly as for an induction motor, and could be operated by unskilled labour.

Mr. D. Weir (British Thomson-Houston Co., Ltd., Rugby) said the synchronous induction motor was technically an interesting machine, but there were grave doubts among some of the leading manufacturers, and among many operating engineers, as to the suitability of that type of motor for the drives commonly met with in practice. For one instance in which the synchronous induction motor could be used advantageously there were ten in which the ordinary salient-pole synchronous motor showed up to much greater advantage. The only advantage that the synchronous induction motor could claim over the self-synchronising salient-pole machine was its high starting torque, but that advantage was obtained at a somewhat formidable price, not only in the matter of initial cost, but also in efficiency, robustness, and to a certain extent, stability. The alternative scheme of driving the load through a clutch should not be lost sight of. How many cases were there in practice where a high starting torque was really unavoidable? How much better surely to employ one of the comparatively simple devices for unloading the apparatus during the starting period! The efficiency of the synchronous induction motor might be 2 or even 3 per cent. lower in some cases. The salient-pole machine for unity power factor operation would on the average be 2 per cent. better in efficiency than the corresponding induction motor, or (taking Mr. Carr's figure of 1 per cent.) the salient-pole machine was at least 3 per cent. better than the corresponding synchronous induction motor. In some cases it might be even from 4 to 5 per cent. better. If the salient-pole machine were designed for .9 power factor leading, the efficiency would still be from 2 to 4 per cent. better than that of the synchronous induction motor—a very material advantage for the salient-pole machine. On the average, the synchronous-induction motor equipment was approximately 23 per cent. dearer than the salient-pole equipment. Those who had to maintain a large installation of induction motors knew what a real difficulty the small air gap was. True, the synchronous-induction motor had an air gap 30 per cent. greater than that of the corresponding induction motor, but nevertheless it was, even at that, still a *small* air gap. Why retain that undesirable feature unnecessarily in those cases where a synchronous machine could be installed?

That the low-voltage exciter was a troublesome feature had been borne out by Major David's remarks. When one considered the very serious drawbacks, the attitude of a few important manufacturers in this country, and of the majority of the large American manufacturers, in refusing to build the synchronous-induction motor, except in very special cases, was quite understandable. If the synchronous-induction motor had a useful field, it was a very limited one indeed.

Mr. P. J. Plevin (Metropolitan-Vickers Electrical Co., Ltd., Cardiff) pointed out that Mr. Carr mentioned that the human element might materially affect the value of the starting current of a synchronous-induction motor, and that by ill-judged switching-in it might exceed the normal by no less than 2½ times. Such a figure was well above the average of the starting currents of salient-pole synchronous machines as guaranteed by the makers and, as expert operation could not always be depended upon, it would seem that one of the chief advantages claimed for the synchronous-induction type over the salient-pole synchronous type vanished, unless the latter was similarly affected.

Mr. C. Clare Atchison (Bitton, near Bristol) explained that supply engineers had not taken enough cognisance of power factor in the past and were reaping their crop of trouble. As to methods of charging, English engineers had not taken power factor into account, but abroad some supply authorities did so and charged a higher price for supplies at lower power factor. If supply undertakings had taken up the question of power factor in some such way originally, they would have had some suitable plant installed and would not be receiving so many inquiries as to how to rectify present troubles.

The discussion was continued by Mr. W. A. Chamen, Mr. C. T. Allan, and Prof. D. Robertson (Bristol University).

Mr. L. H. A. Carr pleaded that his paper should be read. It was stated therein that "the drives most favoured by *operating engineers* are compressors, &c." Not that he recommended them exclusively for compressors, but that *operating engineers* favoured them—a mere statement of fact. It was not at all his intention to push that machine where it had no place, but some customers would have quotations for them, and would put them in, and it was of no use to quarrel with a possible customer because he wished to consider a machine which might not, in the manufacturer's opinion, be the most suitable for the job. People wanted them, and manufacturers had to supply them. With reference to Major David's remarks, what they were all after was fundamental fact, so that the best machine for the purpose could always be put in in any given case. Major David referred to high rotor volts in connection with a starter trouble; surely the rotor voltage had nothing to do with the question. With regard to flameproof sets, synchronous induction motors would not be put forward for use where Regulation 132 applied. The difficulty was the exciter, and existed with any d.c. machine. Mr. Plevin seemed to have misunderstood the point about starting current. The 2½ times full-load current referred to in the paper was synchronising current, not starting current, and was only reached during one cycle. The whole kick only lasted five cycles and could scarcely be measured on an ordinary meter. The author could not agree with all Mr. Weir's figures for the difference in efficiency between salient-pole and induction-type synchronous motors. His relative-price figure was certainly wrong. The synchronous induction motor was just about beginning to take its rightful place, and the reason why it had not already done so was that it has not been sufficiently pushed in the past.

THERMAL EFFICIENCY.

On March 8th an address was given before the Association of Engineers-in-Charge by Mr. A. Hugh Seabrook, M.I.Mech.E., M.I.E.E., on "Large and Small Power Stations in relation to Thermal Efficiency, and other Considerations." Describing himself as a "fuel engineer," he mentioned the extremely high thermal efficiency at which a power plant could be run when there was a constant demand for heat, such as existed at many large private institutions, hotels and the like. His firm was drawing up plans for the reorganisation of the heating and lighting services of an old institution, at present lighted mainly by gas, and served for heat and hot water in a most inefficient manner by 14 boilers. By converting the gas lighting to electric, installing a couple of high-pressure boilers which would supply steam to an electric light and power plant, and by using the waste steam from the latter for heating, hot water, and cooking, an enormous saving could be made over the present costs. This saving was enhanced by the fact that the large boilers could use a fuel costing less than half the price per ton of the fuel at present used. In such a case one drove and heated by electricity everything possible up to a well-defined limit, because, under these special circumstances, electricity cost practically nothing to produce so far as fuel was concerned.

If one considered that little power station as a separate unit, it would make a shockingly poor showing of about 6 to 7 per cent. efficiency from a thermal point of view. But that was not the way to look at it; that power station was only one link in a chain of thermal changes from the raw fuel to the heating radiators, hot-water supply, light, and power, the over-all efficiency of which was expected to reach 50 or 60 per cent. Such a figure could not be approached by an internal-combustion engine plant or the largest and most efficient steam-power condensing electric station that could be built. The reason was that a combined heating and power plant could make use of the latent heat of steam, whereas the condensing steam station could not do so. These high efficiencies could be attained by any steam power station where the conditions were such that the waste heat from the exhaust could be economically utilised.

"In regard to 30-, 40-, or 50-h.p. plants running normal hours (nine hours per day), it seems that (provided reasonable prices can be secured) the cheapest power is that purchased from the electric supply mains, although the latest forms of oil engine run the public supply very closely, particularly if longer hours than the normal are worked. If the power is required intermittently it will probably be found that installations up to, say, 500 h.p. or more, can be run most cheaply from the public mains even when the rate of charge is comparatively high. Also, where more power is required in summer than in winter, the public supply is probably the cheapest.

"Where the machinery to be driven is concentrated and can easily be reached by one power unit directly coupled to it, a single large gas or oil engine is generally the cheapest form of power to install. Where, although the same amount of power is required, it is split up among a number of units, if current can be obtained at about 1.5d. to 2d. per kilowatt-hour, the public supply is cheapest, because if a works power plant be installed it has first to drive an electric generator, which in turn has to drive the individual motors, thus more than doubling the capital cost as compared with that of a direct-connected engine with no electric generator."

Referring to the super-station of, say, 200,000 kW, Mr. Seabrook said that even the best of these did not give more than about 17 per cent. thermal efficiency in actual practice, and a very highly skilled staff and perpetual vigilance were required to maintain that figure. The small 100-h.p. plant could easily equal it, in fact, it could largely exceed it, where waste-heat boilers were fitted to the exhausts. The greatest difficulty with the super station was the transmission—the bigger the generating station, the bigger and more costly the transmission and distribution system; and the 17 per cent. efficiency at the power station was greatly drawn upon by the time the kilowatts were transformed up (probably twice), delivered to the consumer (perhaps 20 miles away), probably transformed twice, and perhaps converted once, before the power was in a usable form. This in all probability reduced the thermal efficiency *at the point of use* to about 12 per cent., whereas the small 100-h.p. plant rendered its thermal efficiency of 17 per cent. at the *consumer's works*.

Looking at actual cases, they could, more often than not, buy electric power from quite small and medium-sized stations cheaper than from the largest. Also the profits made by the biggest undertakings did not appear to be greater in proportion than those made by the smaller ones. He saw very strong evidence in favour of decentralisation rather than concentration; and the construction of power stations on more modest lines appeared to him to promise far more useful results. People were now inclined to proceed on less grandiose lines, viz., in the direction of medium-sized power stations, and he believed they were right.

The Metallurgical Aspect of Electric Welding.—At a recent meeting of the Sheffield Society of Engineers and Metallurgists, Mr. J. H. Paterson, D.Sc., of Newcastle-on-Tyne, lectured on "The Metallurgical Aspect of Electric Welding." To a considerable extent the lecture was devoted to the consideration of nitrogen and oxygen in steel. Mr. Paterson referred to the various processes of welding, and laid down the assertion that the correct current-strength at which to weld was the highest possible—certainly the higher the current-strength the more perfect would be the weld. The percentage of oxygen varied according to the strength, existing in globules in the metal, and, though generally nitrogen had a bad effect on the steel, it had at the same time a tendency to strengthen. His own experiments at Newcastle had been conducted with the help of a specially-prepared iron box with a glass front, and four openings for experiments, and he had found that, by this means, he could arrive at any strength he wished, often without the least trace of foreign or objectionable matter. It had been of very great use to him in his experimental work. It was possible even then to find occasionally that nitrogen could not be wholly excluded, but at the most it was no more than .025 per cent., so that it was practically negligible.—*Sheffield Daily Telegraph.*

Renovating Glow Lamps in Finland.—It is calculated that the annual consumption of glow lamps in Finland amounts to 2,000,000. The Suomen Sähkwlamp-putedehdas, O.Y., of Helsingfors, has now started a factory for the restoration of worn-out lamps according to methods devised in Finland. The capacity of the factory is 300/400 lamps per day.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Castell" Figure Lock.

The Castell figure lock is a new type of lock which has been designed for use on oil-switch cell doors.

It has been a practice in the past to supply for use on these doors substantial padlocks of the Yale type, and, also, an additional catch operated by hand, or by a railway key, the purpose of the catch being to hold the door rigidly against the cell frame work. The figure lock, however, replaces the padlock, and obviates the use of the additional catch.

The lock is of simple and strong construction, consisting of a rotatable centre portion in an outer casing. This centre portion, upon which is cast a raised number, can only be turned when a key, having a corresponding sunk number to that on the lock, is inserted, so that it is impossible for any key to open the wrong door. The key has a movement of 90 deg., the figures being in a vertical position when the lock is closed. The master key is similar in design to the figure key, with the exception that the inside base is so formed as to suit any lock. When it is desired, names of

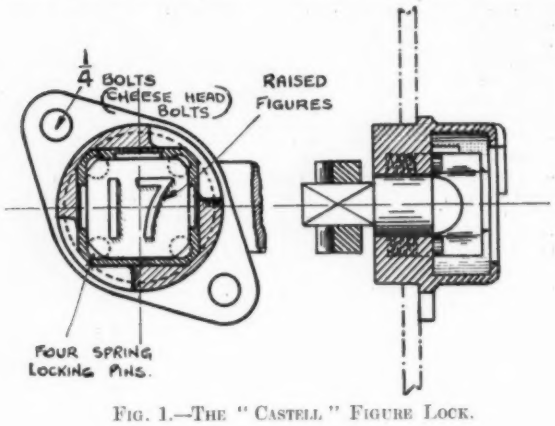


Fig. 1.—The "Castell" Figure Lock.

circuits can be engraved on the square shanks of the keys. The lock is so constructed that the locking lever behind the door can be adjusted horizontally to suit varying thicknesses of floor posts, and, at the same time, it ensures tightly fitting doors.

There can be 99 changes of locks with figures of the size shown in the illustration (fig. 1), although, when required, 999 changes can be provided by using smaller figures.

In cases where cell doors are of such a size as to necessitate locking at the top and bottom corners, a figure lock can be supplied for the top, and a special catch for the bottom. This catch has the adjustable feature of the figure lock, and is designed for operating with the same key.

The locks have a black lacquer finish, the keys being nickel-plated. The inventor is Mr. J. H. Castell, Clun House, Surrey Street, W.C.2.

The Venner Stop-watch.

Messrs. Venner Time Switches, Ltd., of 45, Horseferry Road, London, S.W.1, recently showed us a stop-watch which they are introducing, which possesses exceptional advantages. The dial, about 2 in. in diameter, is divided into ten seconds, each of which is sub-divided into tenths of a second; the minutes dial is sub-divided in sixths corresponding to the complete revolutions of the seconds hand, and reads up to 10 minutes, the dial being printed in two colours. The tenth-second divisions are about 1/16th in. wide, so that readings can readily be made to one-fortieth of a second as easily as to one-fifth on the ordinary dial, and the seconds hand does not start with a jump, but quite smoothly, returning accurately to zero.

The most interesting feature of this watch is the escapement, which is of the usual lever and balance-wheel type, with ruby pallets and a non-magnetic hair-spring, free from temperature error; the balance-wheel oscillates at such a high frequency that its movement can hardly be seen, and consequently the seconds hand appears to rotate not by steps but at uniform speed. The workmanship is of a high order, and the mechanism is enclosed in a tightly fi nickel case. For meter testing, and all similar tests involving the accurate measurement of short periods of time, this is a first-class instrument.

A New Wiring Box.

Mr. Robert Crust, 40 Brook Street, Bradford, has sent us particulars of his "Bradford" connector box, the principal feature of which is the way it ensures continuity in a conduit system. As will be seen from the illustration (fig. 2) this is a circular wooden box into which extension pieces from conduit grips are brought, being fastened by one screw in the centre. The box can be used for mounting all kinds of lighting accessories, such as switches, ceiling roses, &c.

A Convenient Fuse Plug.

A Canadian firm, The "Repeater 6" Fuse Plug Co., of Burlington, Ont., has placed a new type of fuse plug on the market. In this are arranged six fuses, so that when one

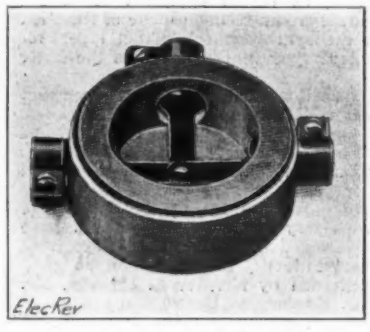


Fig. 2.—The "Bradford" Connector Box.

Fig. 3.—The "Repeater 6" Fuse Plug.

blows another may be put into circuit by a turn of a knob. The illustration (fig. 3) is taken from the *Electrical News* Toronto).

Linking Tumbler Switches.

We have received from Mr. R. A. Macaulay, of 48, Ashton New Road, Beswick, Manchester, a sample of a device for linking two ordinary tumbler switches for use as a d.p. switch, without any modification of the latter. The link is a rod of fibre, split longitudinally, with cavities formed in the two halves to receive the heads of the dollies; when the parts are assembled and held together by screws, the link is securely attached. The device is said to be cheap, time-saving, and adaptable to any switch, and is made in two sizes, for five and 10 amperes.

A similar device has been sent to us by Messrs. Addie and Hartley, 23, Lancaster Avenue, Fennel Street, Manchester. In this case a cylindrical hard-wood bar with hemispherical ends is used. The switch dollies fit into recesses in the ends of this and are covered in by hemispherical caps secured to the bar by means of screws.

The "Ortosafe" Electric Iron.

The "Ortosafe" electric iron, recently placed on the market by Berry's Electric, Ltd., 85, Newman Street, Oxford Street, W.1, embodies an automatic switching device, which ensures that the current is cut off when the iron is laid aside during use. It is too easy for a housewife to leave an iron in circuit if called away to attend to something else, and consequently there is always a chance of the iron overheating and scorching material—or worse—setting it on fire; all this is apart from the waste of energy involved. The "Ortosafe" device con-

Fig. 4.—The "Ortosafe" Electric Iron.

sists, as will be seen from fig. 4, of a bar weighted at one end and attached by its other end to the connector, being pivoted near the back of the iron. When the weighted end falls the connector is removed quickly from its sockets. If it is desired to allow the iron to remain connected to the supply when not in use, it may be placed in an upright position resting on the two projecting plates seen at the back of the iron in the illustration. The iron is at present made in two sizes, 5 and 6 lb., and for voltages ranging from 100 to 250.

REVIEWS.

Engineering Electricity. By Prof. Ralph G. Hudson. Pp. viii+190. Figs. 194. Plates. New York: John Wiley and Sons (Inc.). London: Chapman & Hall, Ltd. Price 13s. 6d. net.

This book contains the substance of a course of some twenty lectures delivered by the author to technical students at the Massachusetts Institute of Technology.

It covers the general principles of the heavier branches of electrical engineering, and is primarily intended for the use of students who are not specialising in this subject.

It will be as well to state at once that the style is very condensed, and that the mathematical exposition of the subject has been used when it appears to be less involved than the verbal method. Consequently, in order to obtain full value from the work, it is essential that the reader should have a sound mathematical basis, the standard being about that of a second-year student in our technical colleges.

The first chapter, which deals with the fundamental conceptions of current, voltage and power in direct-current circuits, is perhaps the most difficult to understand in the whole of the book. The definitions given are very comprehensive, being framed to cover all possible kinds of circuit. This generalisation tends to obscure the meaning of some of the statements, and makes it more difficult for the beginner to grasp the fundamental laws underlying the subject, although it must be admitted that a student who thoroughly masters this initial chapter will have acquired a mental equipment which will enable him to solve most of the problems he may encounter in connection with direct-current circuits.

In dealing with the magnetic field the author uses the terms Maxwell, Gauss, Oersted, and Gilbert as the names of the units of magnetic flux, flux density, reluctance and magnetomotive force respectively. Several attempts have been made to popularise these names in this country, with but little success, and it is rather doubtful whether their use is as common in the United States as is suggested by the manner in which they are introduced into the present work. The term to which most objection may be raised is the Gauss, which represents flux per square centimetre, since the former term conveys nothing to the student, whilst the latter warns him that he must apply a conversion factor if the area considered is measured in some other unit.

The chapters dealing with the practical applications of the theoretical principles are well and clearly written, and cover a wide field. They could, of course, be expanded with advantage, but the limits imposed by the size of the book have necessitated a wise discrimination.

In the chapter on alternating-current circuits useful summaries are given of the relation between the various quantities in series and parallel circuits containing resistance, capacity and inductance.

A novel feature is the inclusion at the end of the book of a number of excellent reproductions from photographs of machines, instruments, &c., in various stages of assembly. This method of collecting the illustrations together in one part of the book has much to commend it, as it is usually impossible for them to coincide exactly with the text, and by this arrangement the attention is not distracted by an illustration which probably has no connection with the letterpress on the page to which it happens to be adjacent. A useful set of magnetisation curves is included, and a copper wire table which would be more valuable if English as well as American sizes were included.

A word of praise is due for the excellent way in which the book is produced. The type is clear and easy to read, and the many diagrams and mathematical formulæ in the text are exceedingly well reproduced.

On the whole the work is well adapted for the class of readers for which it is intended, and it might also serve well as a refresher course for those whose college studies are, unfortunately, only too far behind them.

The Emission of Electricity from Hot Bodies. By O. W. Richardson, F.R.S. Pp. viii+320; figs. 35. London: Longmans Green & Co. Price 16s. net.

This is the second edition of a work first published in 1916, and deals with the exceedingly interesting problems that arise from the atomic decomposition which is promoted by high temperature in material of every kind.

After devoting 29 pages to considerations of a general character which embrace the historical development of the observations made on these phenomena, the author proceeds to set out the main outlines of the theory of emission of electrons from hot bodies. This is based, as our readers will be aware, on the analogy furnished by the escape of molecules in vapour from a liquid or a solid during evaporation. The first calculations of the thermionic currents to be expected at different temperatures, on the view that the discharge from a negatively charged conductor was carried by electrons ejected owing to the vigour of their heat motions, were made by the author twenty years ago, as some of our readers may remember, and the present work contains an account of much of the experimental work which has given fresh evidence in support of his conclusions. Pages 29 to 60, in which the theoretical aspects of the problem are presented, deserve particular attention from all those who desire to obtain an insight into the mechanism of the phenomena in question, because the principles involved are so clearly expressed, and their application is developed in so simple and logical a manner, that it is a pleasure to follow the argument. Of course, the mathematical treatment will be an obstacle to those who have allowed this instrument to become rusty in their minds for want of employment. The difficulties, however, are not so great but that they yield to a little perseverance. The pressure of electrons emitted from a hot body contained in an exhausted vessel of non-conducting material is amenable to the laws ascertained of the working of Carnot's engine. By this method the results are independent of any suppositions about the condition of electrons inside the hot body, and the conclusions arrived at are characterised by a degree of certainty attainable in no other way, inasmuch as the second law of thermodynamics is one of the very few principles in physics to which there is no exception. The emission of positive ions by hot metals occupies 30 pages, and the treatment is admirable. The whole subject is complicated by problems of conduction of electricity, and progress is impeded by the absence of any comprehensive theory of conduction in metallic conductors. Another difficulty lies in the want of a satisfactory explanation of the contact potential difference between metals, with regard to which there has been much controversy. It began more than a century ago, and is still unsettled.

The question is of fundamental importance in the interpretation of the theory of the emission of electricity from hot bodies, and it is to be hoped it will now receive more earnest attention from investigators.

The last chapter deals with the results of some experiments on electrons released by chemical action, the cost of which was partially defrayed by a Government grant through the Royal Society. It is gratifying in these days of heavy taxations to know that some small part, at least, of the money taken from our pockets is put to useful ends. From what has been said, it will be readily seen that this is a book which no one who desires to keep abreast of the developments now taking place in the structure of matter can afford to neglect.

Absolute Measurements in Electricity and Magnetism. By Andrew Gray. Pp. xix+837; figs. 259. London: MacMillan & Co. Price 42s. net.

This important book deals in a masterly way with the subject-matter contained in its title. The present edition embraces in a single volume the ground covered by the two volumes which preceded it, the first of which was published as long ago as 1888. In that interval the direction taken by the progress of physical science has undergone great changes. It is the universal experience in all departments of knowledge, when growth is rapid, that its devotees are now all agog upon one branch of its development, and then all agog upon another. In this case the subjects of physical study have changed so profoundly since the first edition appeared that the author was at one time evidently in doubt whether the theory and practice of absolute measurements in electricity and magnetism would again command serious attention during his lifetime. But though the growth of science may seem one-sided for a period, owing to the fact that scientific men and professors share with their fellow creatures the propensity to flock, before long it always tends to round itself off, and interest sets all the more keenly to neglected aspects of the science on account of their having been so long in abeyance. The immediate cause of bringing attention round to the problem of absolute measurements in this instance was the need that arose out of developments in wireless telegraphy, and this alone will suffice to pin attention upon it for some time to come, in spite of the fact that the mysteries of relativity and the contradictions of the quantum theory tend to divert the interest of physicists to these most fascinating questions. The author at present sees some reason to fear that radio-activity and the phenomena of X-rays may so monopolise the attention of physicists as to lead again to the neglect of more prosaic but essential work in the higher aspects of dynamics. However that may be, the problems dealt with in his book belong to the type to which we must always return, and the manner of his treatment and the arrangement of his matter are on those elemental lines which must inevitably be preserved in future developments of the subject. We may expect that Gray's "Absolute Measurements," like Gray's "Anatomy," will be familiar to students for many a long day, in ever fresh editions brought up to date by men not yet born.

An Industrial Entente.—An interesting feature of a special Lauder performance at the Princes Theatre, on April 26th, will be the presence of prominent leaders of both organised Capital and organised Labour. The performance is to be under the personal patronage of H.R.H. the Duke of York, and the proceeds will go to the Industrial Welfare Society, of which he is president.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sexton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

9,275. "Insulation for electric conductors, &c." W. A. Powell and J. E. Price. March 31st.
9,291. "Electric incandescent lamps." H. Fletcher. March 31st.
9,294. "Electric insulators." Callender's Cable and Construction Co., Ltd., and A. E. Wilson. March 31st.
9,296. "Means for attaching conductors to electric insulators." G. V. Twiss. March 31st.
9,298. "Electric pocket lamps." M. Zeiler. March 31st.
9,302. "System of commutators for automatic telephone exchanges, &c." G. Alfani and L. Mazza. March 31st. (Italy, April 1st, 1921.)
9,306. "Trolley heads for overhead electric conductors." H. Richardson. March 31st.
9,311. "Alternating-current electric instruments." E. W. Hill and G. F. Shotter. March 31st.
9,320. "Call indicator circuits." L. Polinkowsky and Western Electric Co., Ltd. March 31st.
9,321. "Sparking plugs." F. L. Eldridge. March 31st.
9,326. "Terminals for electric couplings." T. Dobson. March 31st.
9,333. "Electric transmission for vehicles." Tilling-Stevens Motors, Ltd., and H. K. Whitehorn. March 31st.
9,350. "X-ray tubes." A. C. Goolden, V. E. Pullin and A. G. Warren. March 31st.
9,353. "Automatic air and oil-break electric switches." Ferguson, Pailin, Ltd., and G. Pailin. March 31st.
9,355. "Electric fuse wire holders." J. McGrath. March 31st.
9,363. "Automatic air and oil-break electric switches." G. Pailin. March 31st.
9,364. "Regulation of hydro-electric power stations." O. Poebing. March 31st. (Germany, April 1st, 1921.)
9,378. "Galvanic batteries." R. E. Beswick and Fuller's United Electric Works, Ltd. April 1st.
9,384. "Sparking plugs." J. H. Chapman. April 1st.
9,401. "Automatic metering for telephone calls." A. J. Wheeler. April 1st.
9,412. "Magnetic lifting apparatus." J. Russell. April 1st.
9,419. "Electric switches for motor vehicles." N. A. Block and J. W. Coward. April 1st.
9,435. "Device for indicating burning out or failure of electrical apparatus." E. Elmes. April 1st.
9,442. "Automatic devices for charging accumulators." C. M. E. Franklin. April 1st.
9,443. "Power transmission systems." Metropolitan-Vickers Electrical Co., Ltd. April 1st. (United States, April 12th, 1921.)
9,454. "Electrical fly killer." C. Ruffin. April 1st.
9,459. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. April 1st. (United States, April 1st, 1921.)
9,463. "Tubular metal casings for electric conductor wires." G. W. Humphry. April 1st.
9,464. "Measurement of high electrical resistances or ionisation strengths." W. Brandt. April 1st. (Austria, April 2nd, 1921.)
9,467. "Antenna systems for wireless communication." E. Y. Robinson. April 1st.
9,469. "Measurement of high electrical resistances or ionisation strengths." S. Strauss. April 1st. (Austria, April 2nd, 1921.)
9,489. "Electro-magnetically-operated hooters." R. Bosch Akt. Ges. April 3rd. (Germany, April 18th, 1921.)
9,519. "Printing-telegraph machines." O. L. Kleber. April 3rd.
9,521. "Electric gas lamps with glow discharge." Patent-Theuhand Ges. für Elektrische Glühlampen. April 3rd. (Germany, April 4th, 1921.)
9,526. "Telephone repeater systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). April 3rd.
9,527. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). April 3rd.
9,529. "Electrostatic condensers." E. W. Dorey. April 3rd.
9,547. "Earth inductor devices." Aeronautical Instrument Co. April 3rd. (United States, August 13th, 1921.)
9,560. "Devices for recording telephone calls." J. S. Ross. April 3rd.
9,569. "High-speed dynamo-electric machines." Soc. Anon. pour l'Exploitation des Procédés M. Leblanc-Vickers. April 3rd. (France, April 16th, 1921.)
9,590. "Electric control means." J. R. C. August and E. K. Hunter. April 4th.
9,626. "Illuminated night and day sign for motor vehicles." A. H. Thompson. April 4th.
9,685. "Electric railway signals." F. H. Robinson and W. F. Topley. April 4th.
9,686. "Frequency-regulators for alternating-current circuits." F. W. Le Tall (Westinghouse Electric and Manufacturing Co.). April 4th.
9,739. "Boxes for electric lamps." A. H. Stevenson and H. G. Thompson. April 5th.
9,742. "Cycle dynamo lamps and transmission appertaining thereto." W. J. Newman. April 5th.
9,763. "Means for rectifying alternating currents, &c." T. F. Wall. April 5th.
9,768. "Electric torches." A. A. King. April 5th.
9,769. "Current collectors." N. Clough. April 5th.
9,770. "Systems of electric traction and suspension means for overhead conductors therefor." N. Clough. April 5th.
9,775. "Amplifying wireless signal currents to work recording instrument." S. W. Bligh and E. L. Crowe. April 5th.
9,783. "Cabinet for telephone call boxes, &c." H. P. C. Estler. April 5th.
9,786. "Safety devices for switch hooks of telephone instruments." Compagnie Française pour l'Exploitation des Procédés Thomson-Houston. April 5th. (France, April 8th, 1921.)
9,842. "Electrical control gear." F. Addie and A. G. Hartley. April 6th.
9,867. "Sparking plugs." A. D. Cook. April 6th.
9,874. "Electric motors." W. R. Macdonald. April 6th.
9,876. "Electric mincer." H. E. Holman. April 6th.
9,886. "Prepayment electricity meters." F. Holden and Measurement, Ltd. April 6th.
9,902. "Electrical insulating device." F. C. B. Chase. April 6th.
9,910. "Headlights for motor-cars, cycles, &c." A. E. Watson. April 7th.
9,911. "Reducing self-induction and eddy-current losses in underground electric cables." A. M. Taylor. April 7th.
9,912. "Device for ensuring electrical continuity in systems of electric steel conduits." W. E. Roberts. April 7th.
9,924. "Dynamo-electric machines." L. J. Vann. April 7th.
9,925. "Vents for electric storage batteries." R. E. Beswick and Fuller's United Electric Works, Ltd. April 7th.
9,929. "Detachable connectors for connecting up flexible cables to electric kettles, &c." E. Townshend & Townshends, Ltd. April 7th.
9,931. "Automatic time switch for electric light." P. G. Barden. April 7th.
9,941. "Electric incandescent lamps." Parker, Winder & Achurch, Ltd., and J. F. Pennefather. April 7th.
9,947. "Automatic circuit-breakers." Crompton & Co., Ltd., and W. F. Jones. April 7th.
9,948. "Submarine signalling." J. Twaddle. April 7th.
9,960. "Means for selective reception of alternating currents." F. E. Pernot and L. J. Rich. April 7th.
9,968. "Electric pocket lamp." P. Rombach. April 7th. (Germany, November 1st, 1921.)
9,970. "Amplifiers for wireless telegraphy and telephony." O. R. C. Sherwood. April 7th.
9,982. "Electric motor control." British Thomson-Houston Co., Ltd., C. T. Hanna, and H. C. Hastings. April 7th.
9,997. "Long telegraph cables." Western Electric Co., Ltd. April 7th. (United States, August 16th, 1921.)
10,002. "Methods of reciving in telephony and in wireless telegraphy and telephony." A. E. O'Dell (Lorenz Akt. Ges.) (W. Scheppmann). April 7th.
10,003. "Electric regulating resistances for switches, &c." Schweizerische Gasapparate Fabrik Solothurn und Elektra Fabrik Elektrischer Heiz-und Kochapparate. April 7th. (Switzerland, April 13th, 1921.)
10,010. "X-ray apparatus for localisation of foreign body in the eyeball." D. B. McGregor. April 8th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

15,687. "Electric fuse boards, distribution boards, and the like." B. Quarmby. March 5th, 1921. (177,181.)
28,782. "Spark-strengtheners, especially in connection with combustion power engines with several cylinders." A. Nissen. October 11th, 1920. (177,190.)
29,515. "Thermionic generators of high-frequency electric oscillations." H. J. Round and P. P. Eckersley. October 19th, 1920. (177,193.)
32,296. "Electric accumulators or storage batteries." H. Leitner. November 16th, 1920. (177,198.)
32,472. "Arrangements for the electric heating of water and other fluids." Festa Akt. Ges. November 20th, 1919. (154,189.)
33,004. "Means for minimising coupling between receiver and transmitter amplifiers in a high-frequency signalling system." R. Fiedler and K. Hopfner. February 5th, 1920. (158,536.)
35,352. "Cord grips for electrical apparatus." A. Kirk and R. C. Milliken. December 15th, 1920. (177,217.)
35,380. "Arrangements for indicating the position of apparatus or the condition of circuits at a distance." Automatic Telephone Manufacturing Co., Ltd., Electrical Improvements, Ltd., A. E. Hudd and J. R. Beard. December 16th, 1920. (Cognate application 26,836/21.) (177,218.)
35,528. "Electric fuses." O. Cracoanu. December 17th, 1919. (155,547.)
35,755. "Calling devices adapted to be operated by wireless signals." W. J. Davis. December 20th, 1920. (177,240.)
35,866. "Battery lamps suitable for use by horsemen." H. R. W. Wood. December 21st, 1920. (177,246.)
35,953. "Charging of electric storage batteries." W. H. Thorpe and M. S. Willing. December 22nd, 1920. (177,252.)
36,133. "Electric transformers." Reiniger, Gebbert & Schall, Akt. Ges. May 16th, 1918. (155,832.)
36,134. "High-tension electric transformers." Dr. F. Dessauer. June 23rd, 1920. (165,435.)
36,142. "Electric controllers, starters, switches, and the like." J. O. Powell. September 23rd, 1921. (177,263.)
36,170. "Filter electrodes for electrolysis." Traun's Forschungslaboratorium, Ges. H.O. July 5th, 1918. (155,835.)
36,233. "Wireless transmitting apparatus." Marconi's Wireless Telegraph Co., Ltd. (N. E. Davis). December 24th, 1920. (177,267.)
36,251. "Valve transmitters for wireless telegraphy and telephony." L. G. Preston, H. Morris-Airey, and G. Shearing. December 24th, 1920. (177,269.)
36,252. "Supports for filaments in thermionic valves and other vacuum tubes." L. G. Preston, B. Hodgson, and S. R. Mullard. December 24th, 1920. (177,270.)
36,520. "Alternating-current motors." R. Kimura and T. Seisakusho. December 30th, 1920. (Addition to 168,695.) (177,273.)
36,622. "Sparking plugs." S. Fisher. December 31st, 1920. (177,277.)

1921.

231. "Means for determining the distance and direction of a source of wireless and submarine sound signals." A. U. Sarnmark. December 1st, 1919. (156,230.)
1,434. "Connections of electric discharge vessels for amplifying electric currents and potentials." J. Massole, Dr. J. Engl, and H. Vogt. April 10th, 1919. (157,733.)
1,446. "Arrangement of circuits for thermionic amplifiers." J. Massolle, Dr. J. Engl, and H. Vogt. October 9th, 1919. (Addition to 157,733.) (157,746.)
1,457. "Arrangement for mounting and sealing tight of diaphragm for sound apparatus." Signal Ges. April 7th, 1917. (157,754.)
1,605. "Electrically-heated boilers." E. Meystre. December 5th, 1918. (157,904.)
1,792. "Manufacture of telephone cables." Johnson & Philips, Ltd., and C. F. Street. January 11th, 1921. (177,290.)
1,859. "Electric switches for the headlights of motor vehicles and the like." J. H. Austin. January 12th, 1921. (177,291.)
2,365. "Electric junction boxes." F. Cox. January 18th, 1921. (177,304.)
3,157. "Electric rectifiers." P. Freedman. January 26th, 1921. (177,315.)
4,093. "Charging-hoppers for electric furnaces." C. T. Thorssell, E. C. Friis-Beck, and E. E. D. Edlundh. February 3rd, 1921. (177,328.)
4,995. "Electron-discharge devices." General Electric Co., Ltd., and A. C. Bartlett. February 12th, 1921. (177,345.)
5,465. "Vent-plugs for electric accumulators and the like." A. L. Davis. February 17th, 1921. (177,355.)
5,490. "Electric signalling." B. Davies and Eastern Telegraph Co., Ltd. February 17th, 1921. (177,356.)
5,553. "Device for preventing vibration destroying the filaments in electric lamps." A. McArthur. February 18th, 1921. (177,357.)
6,031. "Electric switches particularly adapted for firing explosives." J. A. MacDonald. February 22nd, 1921. (177,361.)
6,235. "One-way transmission gear for use with train-lighting apparatus and the like." L. C. H. Mensing. February 24th, 1921. (177,363.)
8,079. "High-tension distributors for electric ignition apparatus." M-L. Syndicate, Ltd., and A. P. McGowran. March 15th, 1921. (177,392.)
8,823. "Rheostats." N. G. Langrish and Metropolitan-Vickers Electrical Co., Ltd. March 22nd, 1921. (177,399.)
9,352. "Dipping tanks for coating electrical apparatus and machinery." H. D. Symons. March 22nd, 1921. (177,403.)
13,668. "Current-collecting shoes." J. D. Twinberrow and H. E. Gaze. May 13th, 1921. (177,433.)
14,550. "Electric motor controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). May 25th, 1921. (177,438.)
15,591. "Control systems for electric motors." Mefropolitan-Vickers Electrical Co., Ltd. June 9th, 1920. (164,356.)
22,149. "Electrical protective relay apparatus." Metropolitan-Vickers Electrical Co., Ltd. September 17th, 1920. (169,152.)
32,352. "Electric switches." Metropolitan-Vickers Electrical Co., Ltd. December 2nd, 1920. (172,318.)

1922.

2,396. "Electric relays." Metropolitan-Vickers Electrical Co., Ltd. February 26th, 1921. (176,333.)
3,849. "Electric accumulators or storage batteries." H. Leitner. November 16th, 1920. (Divided application on 177,198; cognate application 25,436/20.) (177,479.)